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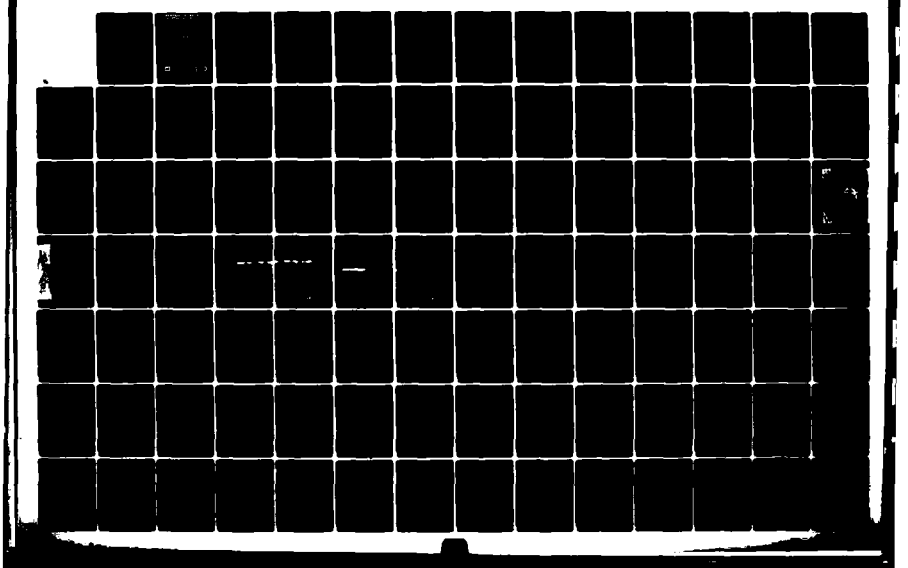

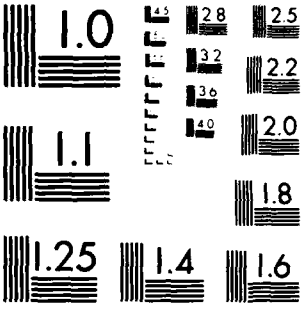

EMBANKMENT CRITERIA AND PERFORMANCE REPORT

(2)

MAY 1984

AD A142769

SALT CREEK AND TRIBUTARIES, NEBRASKA

SITE 18

BRANCHED OAK DAM AND LAKE

US Army Corps of Engineers
Omaha District

DISK 39-C
PROJECT C6657

SALT CREEK AND TRIBUTARIES

BRANCHED OAK DAM AND LAKE

SITE 18

RAYMOND, NEBRASKA

EMBANKMENT CRITERIA AND PERFORMANCE REPORT

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CORPS OF ENGINEERS
OMAHA DISTRICT

SALT CREEK AND TRIBUTARIES
BRANCHED OAK DAM AND LAKE
SITE 18
RAYMOND, NEBRASKA

EMBANKMENT CRITERIA AND PERFORMANCE REPORT

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PERTINENT DATA
SITE 18

1. Reservoir Data

Drainage Area	88.7 square miles
Permanent Pool Area	1,800 acres at El.1284.0 (Conservation Pool)
Sediment Storage	13,250 acre-feet
Flood Control Capacity Below Spillway Crest	14.9 inches of runoff

2. Embankment

Type	Homogeneous rolled fill
Crest Elevation	1320.0 feet m.s.l.
Maximum Height above Streambed	80 feet
Height above Valley Floor	68 feet
Crest Width	32 feet
Crest Length	Approximately 5,200 feet
Slope Protection	Grass
Wave Erosion Protection	Riprap
Seepage Control	Pervious vertical drain with intermittent outlets
Compacted Fill Quantities	Approximately 2,524,400 cubic yards
Berm Fill Quantities	Approximately 297,400 cubic yards

3. Emergency Spillway

Type	Uncontrolled, grassed, earth channel
Side Slopes	1V on 3H
Crest Elevation	1311.0 feet m.s.l.
Crest Length	300 feet
Width (Bottom)	200 feet
Length	Approximately 1,900 feet
Excavation	Approximately 607,000 cubic yards

4. Borrow

Quantity	Approximately 2,147,000 cubic yards

5. Outlet Works

Type Inlet	Concrete Drop
Service Gate	4'x6' Vertical Lift, Hand Operated, Bottom Elevation 1274.0 feet m.s.l.
Conservation Pool Outlet	2 - 3.5'x12', 1284.0 feet m.s.l.

5. **Outlet Works Cont'd**

Water Rights Gate	10" Diameter Vertical Lift, Hand Operated, Bottom Elevation 1276.3 feet m.s.l.
Conduit Type, Size, and Length	1 - 72" Ø RCP x 408' long
Seepage Control	Five Seepage Diaphrams
Stilling Basin	Saint Anthony Falls Type
Outlet Channel	
Length	1,100 feet
Excavation Quantity	91,000 cubic yards
Discharge Capacity @ Pool El. 1311.0 feet m.s.l.	1,320 c.f.s.

6. **Downstream Discharges.** Assuming the service outlet is 50 percent operative, the maximum discharge downstream from the reservoir would be 660 c.f.s. for the Reservoir Design Flood, which is well within the bankfull capacity of 2,700 c.f.s. In the event of a probable maximum flood occurrence, the maximum outflow would be 4,800 c.f.s. and would exceed the downstream capacity for a period of several days.

7. **Pertinent Storage Levels.**

Feature	Elevation Ft. MSL	Area Acres	Storage A.F.
Top of Dam	1320.0	4,460	133,966
Embankment Design Flood	1317.3	4,207	122,283
Spillway Crest	1311.0	3,640	97,556
Reservoir Design Flood	1295.1	2,466	49,491
Conservation Pool	1284.0	1,780	25,994
Sediment Pool	1275.7	1,272	13,250
Gated Outlet	1274.0	1,160	11,224

The 100-year sediment allowance is 13,250 acre-feet. This is an average depth of 2.8 inches over the basin.

8. **References.** For additional information and description on the construction background, operational data, or procedures regarding this dam and lake, reference is made to the "Branched Oak Dam and Reservoir, Operation and Maintenance Manual," dated July 1981; "Design Memorandum No. MSC 20, Branched Oak Dam and Reservoir," dated June 1965; "Periodic Inspection Reports," dated July 1968, September 1969, November 1970, July 1972, October 1974 and October 1979; and "Plans and Specifications for Branched Oak Dam and Reservoir," March 1966.

SALT CREEK AND TRIBUTARIES
BRANCHED OAK DAM AND LAKE
SITE 18
RAYMOND, NEBRASKA

EMBANKMENT CRITERIA AND PERFORMANCE REPORT

1. INTRODUCTION.

1.1. Purpose of Report. This report provides a summary record of significant design, construction, and operational data on Branched Oak Dam for use by engineers to familiarize themselves with the project, reevaluate the embankment when unsatisfactory performance occurs, and provide guidance for designing comparable future projects. It was prepared in accordance with MRD-R 1110-1-8, subject: "Construction Foundation Reports and Embankment Criteria and Performance Reports," dated 27 February 1978 and ER 1110-2-1901, subject: "Embankment Criteria and Performance Reports," dated 31 December 1981.

1.2. Authorization and Purpose of Project. Project authorization was provided by Public Law 85-500, 85th Congress, commonly referred to as the "Flood Control Act of 1958." Authority was granted to construct a flood control project on Salt Creek and Tributaries, Nebraska, essentially in accordance with the report of the Chief of Engineers contained in House Document 396, 84th Congress, 2nd Session. Branched Oak Dam is one of the features of the authorized project. The dam was designed and constructed by the Corps of Engineers as part of a system of 10 dams and reservoirs on the tributaries of Salt Creek above the City of Lincoln, Nebraska, for flood control, fish and wildlife conservation, and recreation. The permanent pool is maintained and operated for fish and wildlife conservation and recreation by the State of Nebraska Game and Parks Commission for public use.

1.3. Location and Description of Project. Branched Oak Dam is located in the southeastern part of Nebraska in Lancaster County, approximately 4 miles west of Raymond, Nebraska. See the Project Location Map, Plate A1,

Appendix A. The main features of the dam consist of an earth embankment, grassed emergency spillway, and concrete outlet works structure. These are located as shown on Plates A2, A3, and A4. Aerial views of the completed project are shown on Plates B1 and B2, Appendix B.

1.4. Project Maintenance. Major repairs of the embankment, spillway, outlet works and discharge channel are the responsibility of the Corps of Engineers. The Nebraska State Game and Parks Commission is responsible for routine maintenance, such as repair of minor slope erosion, control of burrowing animals, and maintenance of grass cover. The State is also responsible for maintaining the conservation pool for fish and wildlife conservation and for recreational purposes.

1.5. History of Project Design.

1.5.1. Survey Report. The initial recommendations for construction of a system of dams on tributaries of the Salt Creek were made in the "Survey Report on Flood Control for Salt Creek and its Tributaries, Nebraska and its Supplements" dated January 1953. This report formed the basis for Congressional authorization.

1.5.2. General Design. In December 1960, the "General Design Memorandum," No. MSC-1, was submitted to higher authority. The report updated the survey report in terms of economic feasibility and provided an overall general design of the multi-dam Salt Creek Project.

1.5.3. Final Design. Final design of Branched Oak Dam (Site 18) is covered in Design Memorandums MSC-20, Branched Oak Dam and Reservoir, and MSC-20, Supplement A, Revised Section V - Earthwork. These reports present detailed designs of the earth embankment, emergency (earthen) spillway, outlet works, and the necessary bridge, road, and utility alterations.

1.6. **History of Project Construction.** Branched Oak Dam was constructed by contract, under the supervision of the Corps of Engineers, Omaha District. Contract No. DA25-066-CIVENG-66-0127, Branched Oak Dam and Reservoir, was advertised on 1 March 1966 and bids were opened 7 April 1966. Brandt Construction Incorporated and John H. Brandt (in a joint venture) were awarded the contract. The contract bid was $1,447,604, which was $231,194 below the Government Estimate. Final payment though, amounted to $1,459,017 due to modifications to the contract and payment of actual quantities.

Work on the project was ordered to proceed by 10 May 1966, and was completed in two construction seasons, with a final completion date of 31 December 1967. In the first construction season (August 1966 to November 1966), the contractor was required to complete the outlet works intake structure to elevation 1280.0, and the right and left abutment sections of the dam embankment to a minimum elevation of 1272.0. Also, from a point 200 feet right to 200 feet left of centerline of the outlet works, (Sta. 39+20 to 43+20), the crest was to be constructed to elevation 1320.0. The purpose of this was to obtain practically all of the foundation settlement under the conduit pipe and the intake structure prior to the start of the second construction season (April 1967 to November 1967). Closure, seeding, completion of the embankment, and remaining work was completed during the second construction season.

Additional improvements to the dam, since its original construction, are discussed in section 10.4. in this report.

2. **GEOLOGY.** The Salt Creek drainage basin is located primarily in Lancaster County in eastern Nebraska and lies entirely within the Dissected Till Plains Section of the Central Lowlands Physiographic Province. Pleistocene and Pliocene deposits of glacial, interglacial and eolian origin overlie bedrock, which is at a maximum depth of over 200 feet, although in some localized areas, the bedrock occurs at relatively shallow depths.

Bedrock under the greater portion of the basin is the Dakota Group sandstone and shales of Cretaceous age, with some Permian limestone and shales in the southeastern portion of the basin and Pennsylvanian limestone and shales in the northeastern portion of Lancaster County. In the damsite area, a typical section of the deposits in descending order are as follows: Peorian Loess Formation, Loveland (loess-clay) Formation, Kansan Glacial Drift, Aftonian (interglacial) Formation, the Grand Island Formation, the Seward Formation, and the Nebraskan Glacial Drift. In general, the Salt Creek basin is an eroded and dissected till plain which was covered by two eolian deposits, the Loveland (loess-clay) Formation and the Peorian Loess Formation. Post-Loveland erosion removed most of the Loveland and the remaining Loveland was subsequently covered by the younger Peorian Loess. In many places, especially in the western half of the basin, all the loess, both the Loveland and Peorian, was removed by erosion exposing the underlying glacial drift. In a few local areas, notably in the eastern part of Seward County, southcentral and northeastern part of Lancaster County, and southeast part of Saunders County, all of the Pleistocene deposits have been removed by erosion exposing the underlying bedrock.

3. FOUNDATION INVESTIGATION.

3.1. Subsurface Exploration. A total of 79 borings, 20 to 100 feet deep, were drilled to determine soil characteristics for general and specific design studies of this site. These consisted of 19 borings within the flood-plain alluvium foundation area, 29 borings within spillway and abutment areas, 16 borings within possible borrow areas, and 15 borings within possible recreation development areas. The locations and identifying numbers of these borings are shown on Plate A4. Disturbed moisture and classification samples were taken from each boring at every change in material and at intervals not greater than 5 feet in depth. Disturbed sack samples were taken of representative spillway and borrow area materials, and undisturbed Shelby samples were taken of representative embankment foundation materials. Standard

penetration tests were also taken at those borings which were within the embankment flood plain foundation and outlet works areas. Logs of the borings are shown on Plates A6 through A15.

3.2. Foundation Conditions. The valley foundation soils at this site consisted primarily of clay alluvium derived from Kansan and Nebraskan glacial drift clay, and from Aftonian formation silts and sands, and clay silt loess. The alluvium underlain by the Grand Island and Seward Formations, was primarily classified as lean, sandy, and fat clay (CL and CH). In the left abutment and spillway area, in descending order, the soils were composed of a loess mantle, Kansan drift, and Nebraskan drift. The loess was classified as lean and sandy clay and silt (CL, CH, and ML). It was described as stiff and medium dense, moist and brown, and about 20 feet thick. The Kansan drift was classified primarily as lean and sandy clay (CL and CH) with some sand and was about 30-40 feet thick. It was described as medium stiff to stiff, moist, red-brown and brown. The Nebraskan drift was classified as fat and sandy clay and silt (CH, CL, and ML). It was described as very stiff to hard, moist to wet and gray in color. In the right abutment the loess mantle was absent and the Aftonian formation was present between the Kansan and Nebraskan drift. It was described as stiff, medium dense, moist, light gray, and was classified as silt (ML). The general soil and geologic profile is shown on Plate A5. Specific soil characteristics and laboratory classification within definite areas are shown on the subsequent plates of boring logs Nos. A6 through A15.

4. FOUNDATION PREPARATION. Before work began, all vegetation, such as brush, heavy sod, heavy growth of grass, and all decayed vegetable matter, rubbish, road surfacing, and other unsuitable material within the area upon which fill was to be placed was required to be removed. After completion of the clearing and stripping, all depressions were filled and steep slopes flattened. After filling the depressions, and immediately prior to the placement of embankment fill, the foundation was required to be loosened thoroughly by

scarifying, plowing, or harrowing to a depth of 4 inches. After the removal of roots or other debris turned up in the loosening process, the foundation was compacted in preparation for placement of fill material.

5. EMBANKMENT. A discussion of the design and construction of the embankment is presented in the following sections. It includes a description of the embankment section and materials, the design shear strengths, stability analyses, seepage control, and general construction of the embankment.

5.1. Embankment Section. The embankment is a rolled, homogeneous, impervious earthfill with a pervious embankment drain consisting of a continuous vertical drain with intermittent horizontal outlets. It has a crest length of 5,200 feet and a crest width of 32 feet. It is 68 feet high and has a crest elevation of 1320.0 feet m.s.l.

The slopes of the embankment are as follows:

Upstream	
1 on 3, 1 on 5, 1 on 3	1300-1320
1 on 3	1280-1300
1 on 10	1265-1280
1 on 3	ground-1265

Downstream	
1 on 3	1288-1320
1 on 5	ground-1288

See Plates A16 and A17 for typical embankment sections and details, and Plates B3 and B4 for views of the embankment slopes and crest.

5.2. Embankment Materials.

5.2.1. Earthfill. The embankment was constructed primarily of loess and glacial drift material from spillway excavation, abutment area

borrow, and alluvium from upstream borrow. This material provided a relatively impervious embankment section consisting of 2,524,400 cubic yards of homogeneous rolled earth fill and an additional 297,400 cubic yards of fill in the upstream berm.

5.2.2. Embankment Drain Filter Material. The embankment drain filter material consisted of washed sand, gravel, or crushed stone well graded between the following limits:

Sieve Size	Percent by Weight Passing
3/4 inch	100
No. 4	75-95
No. 16	45-70
No. 200	0-5

5.2.3. Slope Protection. Wave action on the upstream face of the embankment, in the range of the permanent pool, is dissipated on 20 inches of riprap, placed on 6 inches of spalls, which is placed over 6 inches of bedding. Other embankment and excavation slopes are protected by a grass cover, except for the 1V on 10H slope of the upstream berm, between elevation 1270 and 1280 which is protected by a 12-inch layer of gravel. See Plate A17 and Plates B5 and B6 for sections, details, and views of the slope protection.

5.2.3.1. Riprap. Riprap wave protection on the embankment and around the intake structure is a quarried limestone, and specifications required it to be free of thin slabby pieces and be reasonably well-graded between the following limits:

Weight per Stone		Percent of Total Weight
Type A	Type B	Lighter than or Passing
800 lbs.	50 lbs.	100
200 lbs.	20 lbs.	35-55
20 lbs.	5 lbs.	0-10

Quality testing of the riprap material consisted of Bulk Specific Gravity, Soundness in Magnesium Sulfate, and Soundness in Freezing and Thawing.

Type A riprap was used between elevations 1280.0 and 1300.0 and was underlined by 6 inches of spalls placed on 6 inches of bedding material. Type B riprap was used for the outlet works and was underlined by 6 inches of bedding material.

5.2.3.2. Spalls. The spalls were to be at least equal in quality of the stone used for riprap and reasonably well-graded within the following limits:

Sieve Size	Percent by Weight Passing
4 inch	100
1-1/2 inch	55-85
3/4 inch	30-65
No. 4	0-10

5.2.3.3. Bedding. The 6-inch bedding layer used beneath the riprap and spalls consisted of sand and gravel and was required to be reasonably well-graded between the following limits:

Sieve Size	Percent by Weight Passing
3/4 inch	100
No. 4	80-95
No. 16	55-80
No. 200	0-10

5.2.3.4. Gravel Surfacing. The 1V on 10H upstream slope is protected by a 12-inch layer of gravel. The material consisted of sand and gravel and was required to be reasonably well-graded within the following limits:

Sieve Size	Percent by Weight Passing
3/4 inch	100
No. 4	80-95
No. 16	55-80
No. 200	0-20

5.3. Embankment Placement.

5.3.1. General. Specifications required the gradation and distribution of materials throughout the earthfill section of the dam be such that the embankment would be free from lenses, pockets, streaks, and layers of material differing substantially in texture or gradation from surrounding material.

5.3.2. Compacted Embankment Fill. The more impervious fill materials were placed toward the upstream section of the embankment, and the more pervious of the fill materials were placed toward the downstream section of the embankment, so that a transition in permeability was affected from the upstream to the downstream portions of the embankment.

After dumping, the material was spread in approximate horizontal layers over fill areas. The layers were 6 inches thick or less after compaction and had moisture contents ranging from 2 percent above optimum to 4 percent below. Before compaction, each layer of fill was harrowed, if needed, to break up and blend materials and to obtain uniform moisture content. If one pass of the harrow did not break up or blend the materials sufficiently, additional passes were performed, but no more than three passes were required. Each 6-inch layer of material was compacted to at least 95 percent of the maximum density as determined by the Standard AASHO method, T99, Method D. Portions of the fill which could not be compacted with rollers because of space restrictions, were placed in 4-inch loose lift layers and compacted with power tampers to the same degree of compaction as that obtained on other portions of the fill.

During construction, over 1,100 field compaction control tests were taken during the periods of August 1966 to November 1966 (1st Construction season), and April 1967 to November 1967 (2nd Construction season). A summary of the tests is given in the following table.

- SUMMARY OF FIELD COMPACTION CONTROL TESTS -

TYPE TEST	RANGE	MOST PREDOMINANT
MAXIMUM DRY DENSITY (PCF)	95.2 - 120.0	100.1 - 104.7
PERCENT COMPACTION	94.2 - 111.0	97.0 - 102.4
OPTIMUM WATER CONTENT (%)	12.2 - 24.5	17.0 - 22.3
LIQUID LIMIT	14 - 63	40 - 50
PLASTIC INDEX	7 - 46	22 - 29

5.3.3. Embankment Berm Fill. The embankment berm was constructed of borrow area materials in 12 inch thick layers. Compaction was accomplished by the controlled movement of the construction equipment over the fill in such a manner as to obtain the maximum amount of evenly distributed compaction possible. Moisture control was not required except that the upper limit of the moisture content was that which permitted the movement of construction equipment.

5.3.4. Embankment Drain Filter Material. The filter material was placed in 8 inch thick layers and each layer was thoroughly compacted by vibratory plate compactors. The material was placed by methods which eliminated the mixing of earth and the filter material. Filter material

found to be dirty or otherwise contaminated was removed and replaced at no cost to the government.

5.3.5. Slope Protection Placement.

5.3.5.1. Riprap. The riprap was placed on the spall and bedding layers so as to produce a reasonably well-graded mass of rock with a minimum percentage of voids. A tolerance of plus or minus 4 inches from the required slope lines and grades was allowed, except that either extremes of such tolerance was not to be continuous over an area greater than 200 square feet. The riprap was placed to its full course thickness in one operation and in such a manner as to avoid displacing the spall layer and to minimize segregation of the riprap. The desired distribution of the various sizes of stones throughout the mass was obtained by selective loading of the material at the quarry site and by controlled dumping. All stone was required to be placed by means of a clam, orange peel, or skip box. Dumping of stone at the top of the slopes and rolling or pushing them into place was not permitted.

5.3.5.2. Spalls. Specifications required that the spalls be placed on the bedding layer by methods which would obtain the best possible graded mass of uniform thickness. A tolerance of plus or minus 1 inch was permitted in areas not exceeding 200 square feet.

5.3.5.3. Bedding. The bedding material was spread uniformly on the prepared base by methods which did not cause segregation of particle sizes within the bedding. Compaction of the bedding layer was not required, but it was finished to present a reasonably even surface. The average thickness was required to be within plus or minus 1 inch from the required thickness within areas not exceeding 100 square feet.

5.3.5.4. Gravel Surfacing. Specifications required placing of the gravel in a manner which would prevent segregation of particle sizes. The material was placed in one layer and compacted by one complete pass of a crawler type tractor weighing not less than 20,000 pounds.

5.4. **Embankment Settlement.** A total foundation settlement of approximately 3.52 feet was estimated to occur at the maximum embankment section. In computing the settlement, a maximum embankment section of 68 feet high was considered to bear on 42 feet of compressible valley alluvium. This compressible material was divided into a 6-foot top stratum of medium stiff to stiff, primarily lean clay, above a 36-foot thick soft to medium stiff stratum of lean, sandy, and fat clay.

Time settlement studies indicated that approximately 70 percent of consolidation would occur during construction and the remaining 30 percent would occur at a diminishing rate over an indefinite period. The embankment was provided with a 1-foot overbuild to compensate for the continuing settlement. Total foundation settlement to date has been 3.85 feet, of which 3.40 feet occurred during construction. The 1-foot overbuild was therefore sufficient, since only 0.45 feet of settlement has occurred since construction. Foundation settlement gauges indicate that the rate of settlement has leveled off and is now negligible.

5.5. **Laboratory Testing.** Laboratory tests were performed on representative disturbed and undisturbed samples. These tests consisted of the following: (1) mechanical analyses, Atterberg limits, and moisture determinations, (2) compaction tests, (3) consolidation tests, (4) triaxial compression tests, "Q" and "R," and (5) direct shear "S" tests. Laboratory results for the above tests are given on Plates A18 through A25, and a discussion of the triaxial compression and direct shear tests is given below.

5.5.1. **Triaxial Compression Tests.** Twenty-three series of triaxial compression tests, "Q" and "R," were performed on undisturbed samples of alluvium foundation and remolded embankment material, and are discussed below.

5.5.1.1. **Undisturbed Alluvium Foundation.** Eleven series of "Q" tests on alluvial material, along with a study of drill log data,

resulted in the division of the alluvium into stratums A and B for "Q" strengths. Stratum A is the top 8-foot thickness. It is stiff, dry to moist, primarily lean clay. Stratum B consisted of 31 feet of alluvium that ranged from soft to stiff, moist to saturated, silty, sandy, and lean clay, and medium to stiff fat clay. The range in strengths were as follows:

Stratum	Depth-Ft.	Tan ϕ	Coh - T/SF
A	0-8	0.13 to 0.40	0.55 to 1.60
B	8-39	0.0 to 0.03	0.32 to 1.45

Seven series of "R" tests were performed on the alluvium. The alluvium was not divided into stratums for "R" strengths. The range in strengths were as follows:

Tan ϕ	Coh - T/SF
0.19 to 0.25	0.15 to 0.60

5.5.1.2. Remolded Embankment Material. Three series of "Q" tests and two series of "R" tests were performed on representative embankment materials remolded at 95 percent of maximum density and 2 percent above optimum moisture. The resulting strengths were as follows:

Test	Sample	Tan ϕ	Coh-T/SF
Q	C-1, Loess	0.11	0.90
Q	C-2, Drift	0.0	1.32
Q	C-3, Alluvium	0.0	1.30
R	C-2, Drift	0.21	0.31
R	C-3, Alluvium	0.23	0.30

5.5.2. Direct Shear Tests. Seven series of direct shear "S" tests were performed on undisturbed alluvium and remolded embankment materials. The strength results were as follows:

Sample Type	Tan ∅	Coh-T/SF
Undisturbed	0.52	0.20
Undisturbed	0.65	0.0
Undisturbed	0.35	0.38
Undisturbed	0.57	0.10
Remolded (C-1)	0.44	0.40
Remolded (C-2)	0.43	0.40
Remolded (C-3)	0.41	0.0

5.5.3. Adopted Design Values. After evaluating all the test results the following strengths were used in design:

ADOPTED DESIGN VALUES

Material	Unit Weight T/CF		"Q" Case		"R" Case		"S" Case	
	Bouyant	Saturated	Coh T/SF	Tan∅	Coh T/SF	Tan∅	Coh T/SF	Tan∅
Embankment	0.0288	0.06	1.0	-	0.30	0.22	-	0.45
Foundation Stratum "A"	0.0288	0.06	1.0	-	0.25	0.21	-	0.50
Stratum "B"	0.0268	0.058	0.45	-	0.25	0.21	-	0.50

5.6. Embankment Stability. Stability analyses were performed on both the downstream and the upstream slopes at the maximum embankment section positioned over the greatest depth of relatively soft foundation.

5.6.1. Method of Analyses. The wedge and circular arc methods of analyses were used. These are patterned after the finite slice method outlined in EM 1110-2-1902, Appendix III, dated 27 December 1960. The analyses were run using the Omaha District RCA 301 Computer. The most critical failure surface was found by trial and each critical case was then checked manually. The computer and manual results were in close agreement.

5.6.2. Design Cases. Embankment stability analyses were performed for the end of construction, steady seepage, partial pool, and sudden drawdown cases. Stability sections and their respective factors of safety for the design cases are shown on Plates A26, A27, and A28.

5.6.2.1. End of Construction. This case was run using both the circular arc and the wedge method of analyses. Instantaneous placement of the embankment was assumed and the computed factors of safety were 1.24 and 1.26 respectively. These factors are slightly lower than the 1.3 specified in EM 1110-2-1902. However, from experience of previous Salt Creek Dams, it was known that during the 2-year construction period the consolidation of the foundation due to the embankment load would result in an increase in strength to the extent that it was felt that the factor of safety would be above 1.5. Therefore, for this case, the values were considered adequate.

5.6.2.2. Steady Seepage Case. The downstream slope was analyzed by the circular arc method assuming the pool at the spillway level and the pervious drain operative. The "R" and "S" shear strengths were used in separate computations to determine a range of stability values. The respective minimum factors of safety were 1.32 and 1.78.

5.6.2.3. Partial Pool. The upstream slope was studied for the critical pool elevation of 1274.0 (low level gated outlet elevation). The saturation line was assumed horizontal at each pool level. The "R" shear strengths were used in the computations and the minimum factor of safety was 1.54.

5.6.2.4. Sudden Drawdown. The upstream slope stability was analyzed assuming instantaneous drawdown from the pool at spillway level, elevation 1311.0, to the permanent pool at elevation 1284.0. The "R" shear strengths were used and the minimum factor of safety was 1.44.

5.6.3. Summary. As can be seen in the following table, all factors of safety considered critical were either very close to or exceeded those required in the stability manual. Those which were less than that required and still considered adequate were the result of engineering judgment and experience with similar situations.

STABILITY ANALYSES

Case	Shear Strength	Minimum Required Factor of Safety	Computed Factor of Safety
End of Construction	Q	1.3	1.24*
Steady Seepage	R	1.4	1.32**
Steady Seepage	S	1.4	1.78
Partial Pool	R	1.5	1.54
Sudden Drawdown	R	1.2	1.44

*See discussion in section 5.6.2.1.

**The 1.32 factor of safety for the "R" strength was considered adequate when bracketed with the higher "S" case factor of safety of 1.78.

5.7. Seepage Control.

5.7.1. Embankment. Seepage through the embankment was considered negligible due to the relatively low permanent pool, the infrequent interval and short duration of higher pools, and because of the impervious nature of the embankment. An embankment seepage control internal drain consisting of 32,583 cubic yards of compacted pervious material, with outlets, prevents eventual saturation of the downstream embankment slope under all normal long term seepage conditions. The drain is 3-feet wide with a top elevation of 1311.0 (Spillway Crest Elevation). It is located 10 feet downstream from the embankment centerline and has outlets at 50-foot intervals throughout the embankment section. See Plate A16 for typical sections of the embankment drain.

5.7.2. Foundation. An analysis of foundation seepage was made using a method developed by Mr. P. T. Bennett and published in the proceedings of ASCE Vol. III, 1946, entitled, "The Effect of Blankets on Seepage Through Pervious Foundations." The analysis was performed at the maximum embankment section with a pool elevation of 1311.0 (Spillway Crest

Elevation). The depth of the semi-impervious blanket was assumed to be 40 feet and extend infinitely both upstream and downstream. The depth of the pervious sand was considered as 20 feet. In determining the effective length of semi-impervious blanket, ratios of coefficients of permeability of blanket to that of underlying sands (Kf/Kb) were assumed as 1,000 upstream and 800 downstream. A gradient factor of safety of 1.63 was obtained at the downstream toe of the embankment. The minimum allowable gradient factor of safety was 1.5, therefore, underseepage control (such as relief wells) was not required.

5.7.3. Abutment. Seepage was not considered a problem because of the adequate impervious cover which exists over the sands in the abutments.

5.8. Diversion and Closure. A system of temporary dikes and channels as shown on Plate A29, were used to divert the stream flows into a temporary channel constructed through the embankment area. Specifications required the embankment closure section to be constructed to elevation 1274.0 within 6 days after the start of closure operations and to elevation 1288.0 within 10 days. The embankment at elevation 1288.0 then provided sufficient pool volume to contain the runoff from a 100-year flood occurrence probability with about 5 feet of freeboard.

6. EMERGENCY SPILLWAY. The emergency spillway is a grass-lined, uncontrolled, earth cut channel. It is located in the left abutment, approximately 2100 feet from the embankment. It has a slightly-curved alignment, is 200-feet wide, and 1900-feet long. The spillway has a 300-foot long flat crest at elevation 1311.0 at its upstream entrance, and a 0.2 percent downstream bed slope. Side slopes are 1V on 3H. Total spillway excavation was approximately 607,000 cubic yards. The spillway plan and section are shown on Plate A30, and views of the spillway are shown on Plates B6 and B7.

As stated in General Design Memorandum, MSC-1, "Salt Creek and its Tributaries," the spillway channel must be wide enough to pass the Standard

Project Flood routed 5 days after a Reservoir Design Flood (5 inches of runoff), with outlets assumed to be 50 percent operative and spillway velocities not to exceed 8 feet per second. The 8 feet per second limiting velocity was established as the velocity below which serious erosion would not occur. This criteria was far exceeded since the Standard Project Flood routed in the above manner would fail to reach the spillway crest by more than 10 feet.

7. OUTLET WORKS. The outlet works consist of an intake structure, conduit, stilling basin, and outlet channel. Sections and details of the outlet works are shown on Plates A31 through A39 and views of these structures are shown on Plates B7 through B10.

7.1. Intake Structure. The intake structure is a reinforced concrete box shaft with 6-foot by 12-foot inside dimensions and is commonly referred to as a drop inlet structure. The structure has a 4-foot by 6-foot manually operated gated opening located in the upstream side with a crest elevation of 1274.0. The purpose of the gated opening is to lower the level of the conservation pool in order to inspect the conduit, make shoreline repairs, and control fish population. A water rights gate was recently constructed into the intake structure and is used to release water for downstream needs. See section 10.4.4. in this report for more information concerning the water rights gate. There are also two ungated openings in the intake structure, each 3.5 feet by 12.0 feet with crest elevations of 1284.0 (Normal Operating Pool Elevation).

7.2. Conduit. The conduit consists of a monolithic reinforced concrete pipe 72 inches in diameter and 408-feet long. Experience has shown that piping due to seepage is more likely to occur along the conduit than in any other location in or under the embankment. Therefore, in order to eliminate the possibility of piping, five seepage diaphragms were attached to the conduit. They are located near the axis of the dam with spacing between diaphragms of approximately 40 feet.

7.3. Stilling Basin and Outlet Channel. The stilling basin is a Saint Anthony Falls parabolic drop inlet type structure constructed of reinforced concrete. An outlet channel extends downstream from the stilling basin approximately 1,200 feet to the original creek channel. The first 80 feet of the channel downstream of the stilling basin is protected with riprap. The first 70 feet having 15 inches of riprap placed on 6 inches of bedding and the remaining 10 feet having 30 inches of riprap placed on 6 inches of bedding. The remainder of the channel is protected by a grass cover. Excavation of the channel was approximately 91,000 cubic yards.

8. INSTRUMENTATION AND RESPONSE.

8.1. General. Instrumentation for Branched Oak Dam and Reservoir consists of 28 pore pressure piezometers, 32 open tube type (downstream) piezometers, 4 foundation settlement gauges, 7 crest movement markers, 8 vertical movement inserts, and a reservoir stage recorder. Details of the instrumentation are given in the following sections.

8.2. Pore Pressure Piezometers. Twenty-eight pore pressure piezometers were installed at Branched Oak Dam in cross sections A, B, C, and D through the embankment as shown on Plate C1. The purpose of these piezometers is to monitor pore pressure response, migration, and dissipation during and after embankment construction. Twenty-four of these piezometers reach into the alluvium foundation. Four piezometers, one in each cross section, were installed near the embankment centerline with their tips set in fill near the base of the embankment. These four have always been dry with the exception of some seepage water draining down along the outside of the pipes from the manholes to the piezometers. This condition was eliminated when drains were installed in all four of the crest manholes in 1977. Of the original 28 piezometers 21 are currently operable and their water levels are read approximately every three months. The other seven piezometers were installed on the upstream slope of the dam below the normal pool level and have been under water since early 1969. Plots of all the piezometer readings

are shown on Plates C2 through C5. The readings indicate generally good response and in the expected range for these piezometers.

8.3. Open Tube Type Piezometers. There are 32 open tube type piezometers scattered throughout the downstream area of the dam. Plots of the water level readings, depths and locations of the piezometers are shown on Plates C6 through C10. Pressure tests of the piezometers in 1977 indicate that all the piezometers are functional and respond well. Readings indicate that the water levels are within the expected range for these piezometers.

8.4. Foundation Settlement Gauges. There are four foundation settlement gauges located along the centerline of the dam on piezometer lines A, B, C, and D as shown on Plate C11. The maximum settlement has been at gauge C-10U and is about 3.85 feet with approximately 3.4 feet of the settlement occurring during construction. All points appear to have a similar rate of settlement, and recent readings indicate that the rate of movement has leveled off.

8.5. Crest Movement Markers. Seven crest movement markers were placed at 600-foot intervals along the downstream edge of the crest as shown on Plate C12.

Because of the erratic plots of transverse movement shown on Plate C12, the accuracy of the line of sight method of surveys normally used was questionable, and therefore, was replaced by a coordinate method of surveys. Initial surveys in 1977 and surveys in 1980, using the coordinate method, indicate slight downstream movement as can be seen on Plate C13.

The maximum settlement occurs at point MI-2 which is over the valley alluvium near the right abutment, and is approximately 0.69 feet. The maximum differential settlement between points occurs between MI-1 and MI-2 and is approximately 0.73 feet. Overall, the movement plots of these points, given on Plate C12, indicate a very uniform settlement along the embankment except at point MI-2.

8.6. Intake Structure Movement. Four movement insert markers are located in the top of the intake structure as shown on Plate C14. Vertical movement surveys have been taken six times since the original readings were taken in January 1968. Plots of these surveys, shown on Plate C14, indicate a small and uniform settlement of the structure, having less than 0.10 feet total settlement. This stability is credited to its firm foundation of stiff to very stiff sandy and lean clay glacial drift.

8.7. Conduit Movement. Surveys of conduit movement are shown on Plates C15 and C16. With the exception of initial settlement during construction, little conduit movement has taken place. Surveys since March 1967 have shown less than 1 inch of differential movement and have shown no overall trend for the conduit to move either up or down. This stability is credited to the firmer foundation of Nebraskan Drift material under the conduit as opposed to the alluvial clay under the embankment in the valley. A plot of the change in length and a history plot of four vertical movement points along the conduit are shown on Plate C16.

8.8 Reservoir Stage Recorder. The reservoir stage recorder is housed in a 5-foot 4-inch, by 5-foot 4-inch, by 8-foot high concrete block structure located at the crest of the embankment near the outlet works. The instrument records reservoir levels in digital format on paper tape at 15-minute intervals. It is a bubbler type installation whereby the stage is determined by the hydrostatic pressure required to force nitrogen gas out of a submerged orifice. An auxiliary staff gauge with the same datum as the recorder is located near the intake of the outlet structure and extends from elevation 1271.0 feet m.s.l. to elevation 1287.0 feet m.s.l. The gauges are operated and maintained by Corps of Engineers personnel.

9. CONSTRUCTION MODIFICATIONS.

9.1. General. Six contract modifications occurred during the construction of this project. The changes were determined necessary and in the best

interest of the Government. Details of the modifications are given in the following section.

9.2. Contract Modifications.

(Mod. #1) October 1966. Modification No. 1 was a change in the specifications of the contract. Change was necessary to revise construction contract commitments to conform to real estate acquisition commitments. The contract price and time remained unchanged.

(Mod. #2) August 1967. Due to flooding in June 1967, debris consisting of logs and brush were deposited in the reservoir below the elevation of the permanent pool. The Contractor had previously completed the clearing and grubbing required by the contract, and did not by any act or failure to act contribute to the deposit of the debris. Therefore, since the debris was unacceptable in the permanent reservoir, a contract modification was made to allow for payment for removal of the debris. This resulted in an increase of $800 in the contract price. The contract time remained unchanged.

(Mod. #3) September 1967. Due to abnormally bad weather between May and June, it was determined necessary to modify the contract time for performance of all work included in Items 3 and 4 of the Completion Schedule 22 calendar days. Items 3 and 4 consisted of the following: Item 3, complete outlet works and complete right and left abutment embankment; Item 4, complete all remaining work, except seeding. The contract price and completion time for all other work remained unchanged.

(Mod. #4) December 1967. This modification extended the completion date of Item 5 (Seeding) in the Completion Schedule 10 calendar days. The extension was necessary due to Mod. #3 which extended the time for performance of Items 3 and 4. (See Mod. #3). Since Item 4 was prerequisite to Item 5, the time extension was deemed necessary. The contract price remained unchanged.

(Mod. #5) July 1968. This modification gave the contractor an additional 45 calendar days to complete Item 1 (Complete Right and Left Abutment Embankment) of the contract. Misinterpretation of the Plans and Specifications caused an increased haul distance and delayed the completion of the embankment, thus requiring the additional time.

(Mod. #6.) July 1968. This modification provided for reimbursement to the contractor for loss of indirect costs as a result of underrun in quantity of contract Items 10, "Spalls," and 12, "Riprap-Type B." Contract price was increased by the lump-sum amount of $2,841.56. The time for performance was unchanged.

10. OPERATIONAL HISTORY AND PERFORMANCE.

10.1. General. The Secretary of the Army granted a license to the State of Nebraskan and Parks Commission to use and occupy the land and water areas of the Branched Oak Dam and Reservoir for Public Park and Recreational purposes. For consideration of the privileges granted, the State was required to maintain the project in a manner acceptable to the District Engineer. In general, this requires routine maintenance. Any major repairs, either to the embankment, outlet works, or spillway, are accomplished by the Corps of Engineers.

10.2. Inspections. In-depth inspections of Branched Oak Dam and Reservoir are conducted in accordance with ER 1110-2-100, "Periodic Inspections and Continuing Evaluation of Completed Civil Works Projects." The inspections are reported in Periodic Inspection Reports Nos. 1 through 6, dated July 1968, September 1969, November 1970, July 1972, October 1974, and October 1979, respectively. The next periodic inspection of Branched Oak Dam is scheduled for 1984. These periodic inspections are made jointly by representatives of the Operations and Engineering Divisions of the Omaha District Corps of Engineers and by representatives of the Missouri River Division Office. The reports include the evaluation of the embankment, structural performance, and instrumentation observations.

In addition to the periodic inspections, annual inspections are made by the Operations Division of the Omaha Corps of Engineers, and monthly inspections have been performed by Fort Crook Area Forces since 1980. These reports include a comprehensive inspection of all features of the dam.

10.3. Reservoir Levels. Reservoir water surface elevation readings have been recorded daily since the ponding of reservoir water began. Of these readings, one middle of the month observation from each month has been plotted for record and is shown on Plate C6. These daily water surface elevation readings are taken either from the intake structure mounted staff gauge or from the water stage recorder located in the gauge house near the crest of the dam. The highest pool elevation reading ever recorded at this dam was 1286.6 (2.6 feet above normal operating pool) which occurred in October 1973.

10.4. Significant Operational Events.

10.4.1. Crest Road. In 1970, the upstream side of the crest was extended 12 feet by the State of Nebraska for the purpose of building a two-lane paved road across the crest of the dam. All costs and necessary work for completion of the project was the responsibility of the State of Nebraska with approval of the plans, specifications, etc., by the Corps of Engineers. A sectional view of the road is shown on Plate A17, and Plates B13 and B14 show views of the completed road.

10.4.2. Seepage. Branched Oak Dam and Reservoir has a history of seepage along the downstream toe of the embankment. The main areas of concern have been, (1) at the base of the right abutment approximately between sta. 10+00 and sta. 15+00, (2) near the center of the flood plain valley, (3) along the left cut slope downstream of the stilling basin, and (4) from the internal embankment sand drain outlet at sta. 41+00 located back and upstream of the stilling basin structure. Methods used to alleviate the problem in these areas are discussed in the following sections.

10.4.2.1. Relief Well. In 1975, a 6-inch diameter relief well was installed in the downstream embankment toe near the old creek channel at sta. 28+00. The well was used in an attempt to lower the ground water level in that area. It was thought that if it would relieve the hydrostatic pressure in the deeper sand stratum, that the drainage of overlying alluvium would improve, thus lowering the ground water level and minimizing local ponding. Recent inspections indicate that the relief well has been functioning as expected and the ground water level has subsided. Periodic flow measurements of the relief well are shown on Plate C6, and the discharge end of the well is shown on Plate B11. Details of design and a cost summary of the relief well and perforated pipe (discussed in next paragraph) are presented in Design Memorandum No. MSC-23.

Besides the relief well, a 6-inch perforated drain pipe was placed in the same trench parallel to and at the same elevation as the relief well outflow pipe. This drain has flowed steady at approximately 5 gpm and indicates that shallow drains such as this are effective in lowering local high groundwater problems. However, since the relief well is also in the area the actual effect of the shallow drain cannot be determined.

10.4.2.2. Seepage Drains. In 1977-1978, two seepage drains were installed in the vicinity of the stilling basin. A 2-inch pipe was installed into the embankment drain at the toe of the embankment approximately along a line with the centerline of the stilling basin to provide a controlled outlet for any seepage through the drain. The second drain is a 4-inch perforated pipe installed along the left side of the stilling basin cut slope at elevation 1252.0. The purpose of the drain is to provide a controlled outlet for seepage that drains from the left abutment area. According to the 1979 Periodic Inspection Report, these drains were functioning well and keeping the area dry. See Plate C6 for a plot of the flow readings, Plate A39 for drain details, and Plates B12 and B13 for views of the drains.

The drains were installed as part of the Salt Creek - Outlet Works Rehabilitation (Phase I), which included channel cleanout and conduit grouting performed at various other Salt Creek Dams. The work was performed by Technical Inspections Corp. of Lincoln, Nebraska, under contract No. DACW45-77-B-0086. Total contract cost was $114,708.50 with approximately $18,800 allotted for the seepage drains at Branched Oak.

10.4.3. Service Road. In 1976, a crushed rock surfaced service road was constructed along the upstream embankment slope. It was constructed by Theisen Bros. Inc., of Norfolk, Nebraska under Contract No. DACW45-76-B-0100 at a cost of $33,280. The road was built by cutting into the slope along the top side of the upstream slope riprap protection. It was constructed primarily for inspection and more efficient maintenance of the upstream slope. Before the road was constructed, a barge or a temporary construction road cut into the upstream slope was necessary each time riprap repair was required. Details of the design of the road are presented in Design Memorandum No. MSC-25. Plan and sections of the service road are shown on Plate A40. Plates B3, B10, and B11 show views of the service road during and after construction.

10.4.4. Water Rights Gate. In October 1981, a 10-inch diameter gate was constructed into the intake structure as shown on Plate A37. The gate is used to release water for downstream needs. Its small size enables it to be used more efficiently than the structure's 4-foot by 6-foot gate which was originally used.

The gate was constructed by contract (No. DACW 45-81-C-0229) at a cost of approximately $7,000. The contractor was Pro Dive Incorporated of Ottawa, Illinois.

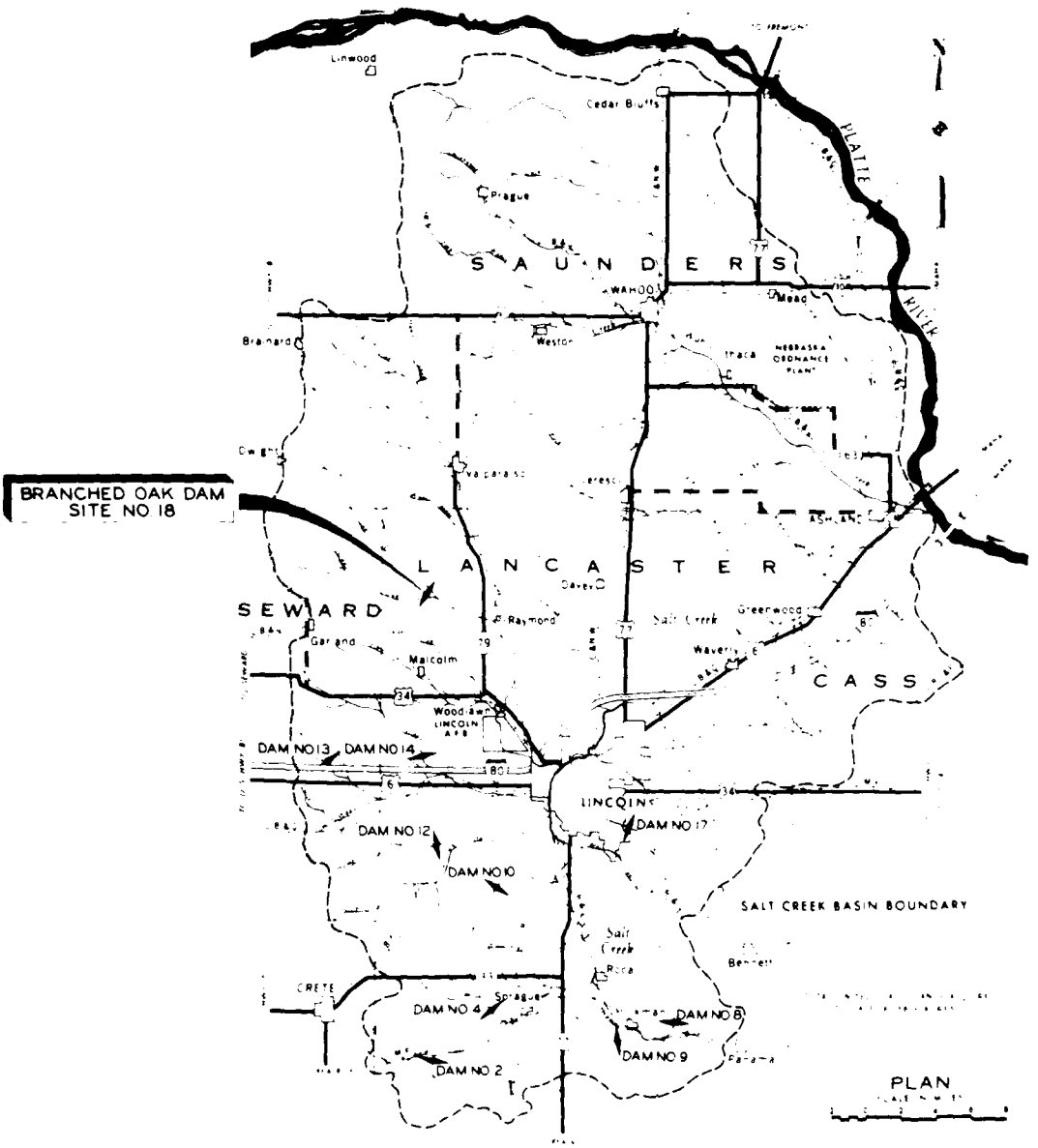
10.5. Performance. The Branched Oak Dam and appurtenant structures are in good condition. Since 1967, when the project was completed, periodic annual, and monthly inspections and evaluations of the instrumentation data

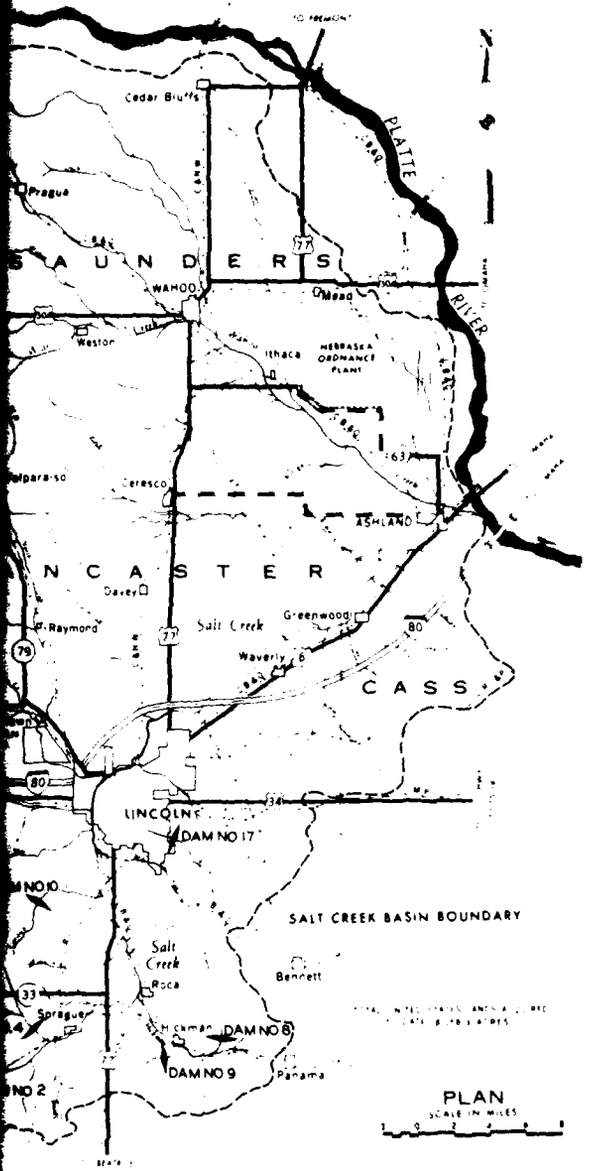
has revealed no significant problems concerning the safety of the dam. The maximum reservoir level attained at Branched Oak Dam since its completion occurred in October 1973 and was 1286.6 feet m.s.l. This was 2.6 feet above the normal operating pool and 24.4 feet below the spillway crest. The project is well maintained, and because of its relative close proximity to the Omaha District Offices, it can readily be inspected if potential problems develop. Maintenance problems which do develop are generally rectified before they turn into major problems which may subsequently affect the integrity of the dam.

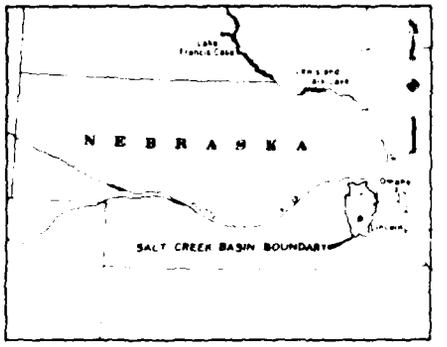
APPENDIX A
DRAWINGS


12,000' A.G.

SALT CREEK, NEBRASKA
BRANCHED OAK DAM
SITE 18
AERIAL PHOTOGRAPH


BRANCHED OAK DAM
SITE NO 18
Linwood
Cedar Bluffs
Prague
SAUNDERS
WAHOO
Mead
PLATTE RIVER
Brainard
Weston
Ithaca
NEBRASKA ORDNANCE PLANT
LANCASTER
SEWARD
Raymond
Salt Creek
Greenwood
Malcolm
Waverly
CASS
Woodlawn
LINCOLN AFB
DAM NO 13
DAM NO 14
LINCOLN
DAM NO 17
DAM NO 12
DAM NO 10
SALT CREEK BASIN BOUNDARY
Salt Creek
CRETE
Sprague
DAM NO 4
DAM NO 8
DAM NO 2
DAM NO 9
Panama
PLAN





LOCATION MAP

U. S. ARMY ENGINEER DISTRICT OMAHA
CORPS OF ENGINEERS
OMAHA NEBRASKA

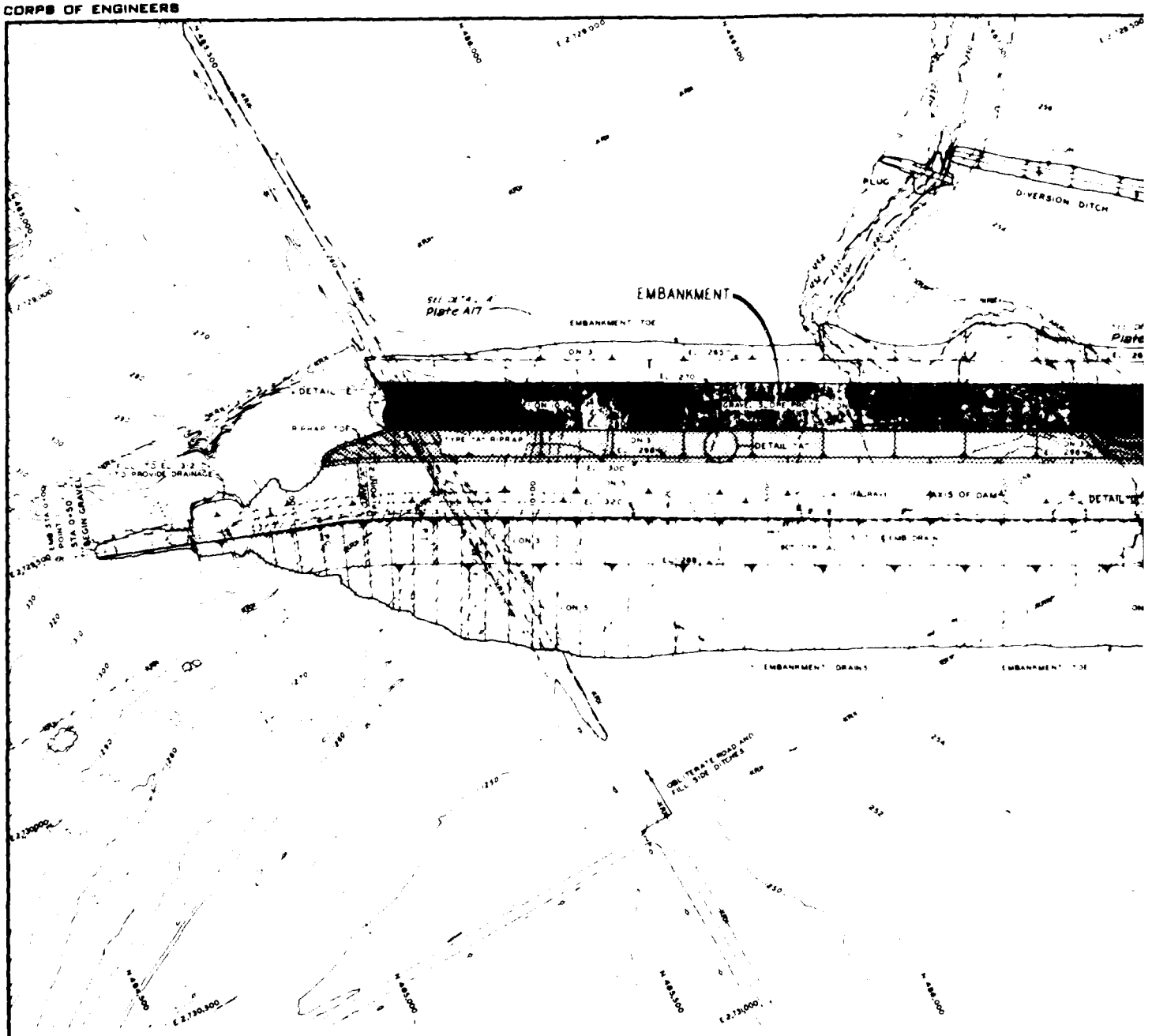
BRANCHED OAK DAM AND LAKE
SITE NC-8

PROJECT LOCATION MAP

SAFETY PAYS

THIS PLAN ACCOMPANIES CONTRACT NO
DACA45 MODIFICATION NO

CORPS OF ENGINEERS



LOCATION OF POINTS

POINT NO.	STATION	COORDINATES NORTH	COORDINATES EAST	BEARING
1	Emb. 0+00	484,760.00	2,729,500.00	
2	Emb. P.I. 6+61.57	485,389.87	2,729,702.32	N17° 48' 27"E
3	Emb. P.I. 46+41.18	488,957.37	2,731,466.24	N26° 18' 28"E
4	Emb. 51+79.56	489,500.00	2,731,500.00	N 3° 33' 42"E
5	Emb. 41+20	488,490.43	2,731,235.25	
6	OW P.I. 600' Rt.	488,224.51	2,731,773.10	S63° 41' 31"E
7	SW Sta. 0+00	492,135.00	2,731,000	
8	SW P.I.	492,870.00	2,732,150	N57° 24' 58"E
9	SW Sta. 28+87.08	492,800	2,733,700	S87° 24' 51"E

EM

U. S. ARMY

CURVE "A" EMB.

Δ	8° 30'02" R
D	4° 00'
T	106.45'
L	212.51'
R	1432.395'
PC	5+55.12
PT	7+67.63

CURVE "B" EMB.

Δ	22° 44'47" L
D	6° 00'
T	192.08'
L	379.11'
R	954.93'
PC	44+49.10
PT	48+28.21

CURVE "C" OUTLET WORKS

Δ	62° 00" R
D	20° 00'
T	172.13'
L	310.00'
R	286.47'
PC	427.87 Rt.
PT	737.87 Rt. on O.W. ℄

CURVE "D" SPILLWAY

Δ	35° 10'11"
D	4° 00'
T	453.97'
L	879.24'
R	1432.4'
PC	9+10.85
PT	17+90.00

LEGEND:

- 1250 — EXISTING GROUND CONTOURS
- 1280 — NEW GROUND CONTOURS
- EXISTING FENCE
- XRX — EXISTING FENCE TO BE REMOVED
- BRUSH AND TREES
- EXISTING UTILITY LINES
- EXISTING BUILDINGS
- U.S. GOV'T. BOUNDARY
- EARTH WORK THIS CONTRACT
- STONE PROTECTION THIS CONTRACT
- GRAVEL SLOPE PROTECTION THIS CONTRACT.

GENERAL NOTE:

1. For applicable General Notes, see PLATE A3.

THIS DRAWING HAS BEEN REDUCED TO THREE-EIGHTHS THE ORIGINAL SCALE

LOCATION OF POINTS

POINT NO.	STATION	COORDINATES NORTH	COORDINATES EAST	BEARING
1	Emb. 0+00	484,760.00	2,729,500.00	N17° 48'27"E
2	Emb. P.I. 6+61.57	485,389.87	2,729,702.32	N26° 18'29"E
3	Emb. P.I. 48+41.18	488,957.37	2,731,466.24	N 3° 33'42"E
4	Emb. 51+79.56	489,500.00	2,731,500.00	
5	Emb. 41+20	488,490.43	2,731,235.25	S63° 41'31"E
6	Ob P.I. 600' Rt.	488,224.51	2,731,773.10	
7	SW Sta. 0+00	492,135.00	2,731,000	N57° 24'58"E
8	SW P.I.	492,870.00	2,732,150	S87° 24'51"E
9	SW Sta. 28+87.08	492,800	2,733,700	

SCALE 1 INCH = 100 FEET

THIS PLAN ACCOMPANIES CONTRACT NO. MODIFICATION NO.

SAFETY PAYS

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

SALT CREEK AND ITS TRIBUTARIES, NEBRASKA

BRANCHED OAK DAM AND LAKE
SITE NO. 18

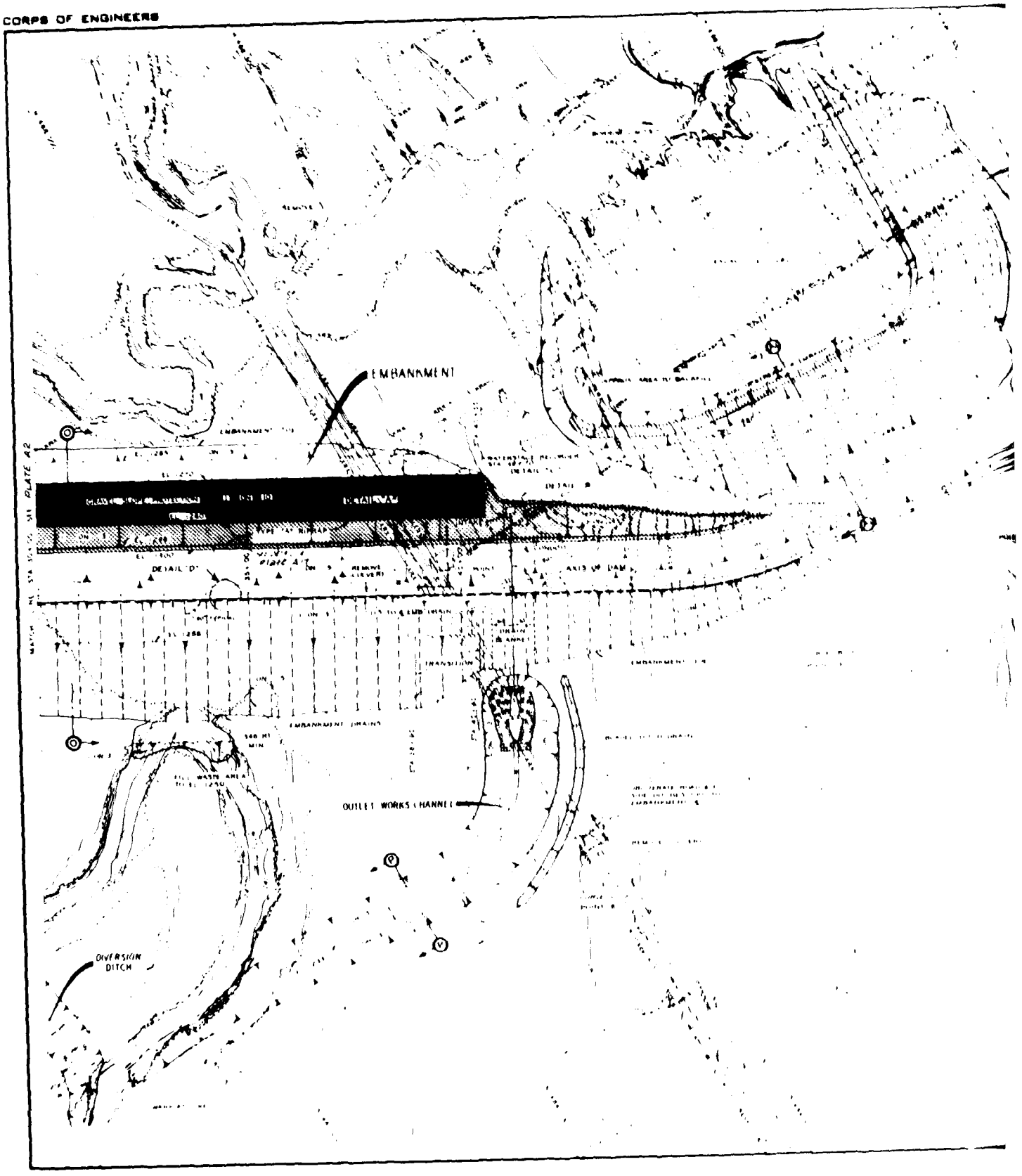
EXCAVATION AND EMBANKMENT PLAN
SHEET 1

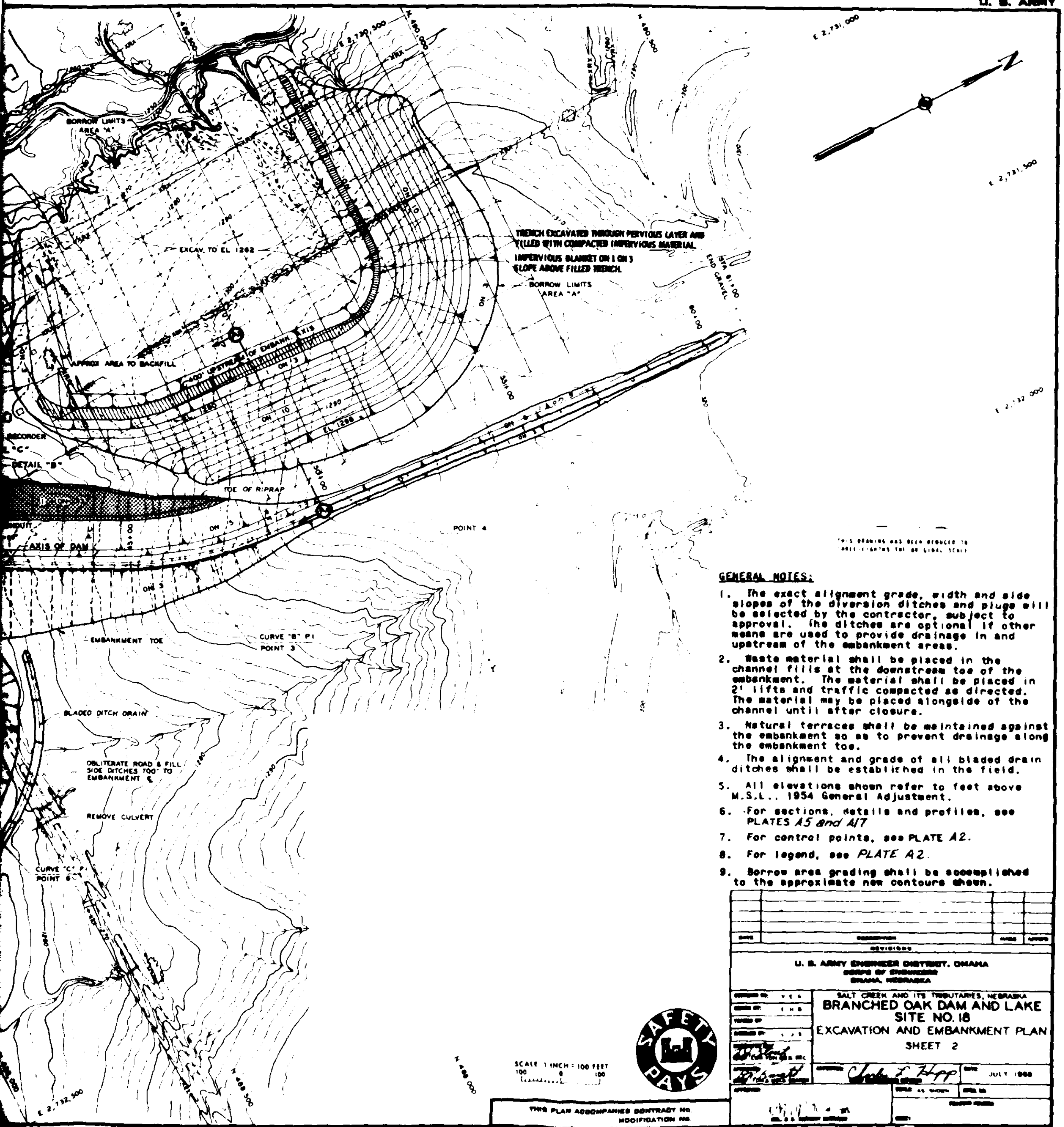
DESIGNED BY V.E.C.
DRAWN BY C.M.O.
TRACED BY
CHECKED BY L.J.S.

APPROVED Charles E. Hoff
DATE JULY 1968
AS SHOWN

EMBANKMENT CRITERIA AND PERFORMANCE REPORT (1983) PLATE A2

CORPS OF ENGINEERS





GENERAL NOTES:

1. The exact alignment grade, width and side slopes of the diversion ditches and plugs will be selected by the contractor, subject to approval. The ditches are optional if other means are used to provide drainage in and upstream of the embankment areas.
2. Waste material shall be placed in the channel fills at the downstream toe of the embankment. The material shall be placed in 2' lifts and traffic compacted as directed. The material may be placed alongside of the channel until after closure.
3. Natural terraces shall be maintained against the embankment so as to prevent drainage along the embankment toe.
4. The alignment and grade of all bladed drain ditches shall be established in the field.
5. All elevations shown refer to feet above M.S.L., 1954 General Adjustment.
6. For sections, details and profiles, see PLATES *A5 and A17*
7. For control points, see PLATE *A2*.
8. For legend, see *PLATE A2*.
9. Borrow area grading shall be accomplished to the approximate new contours shown.

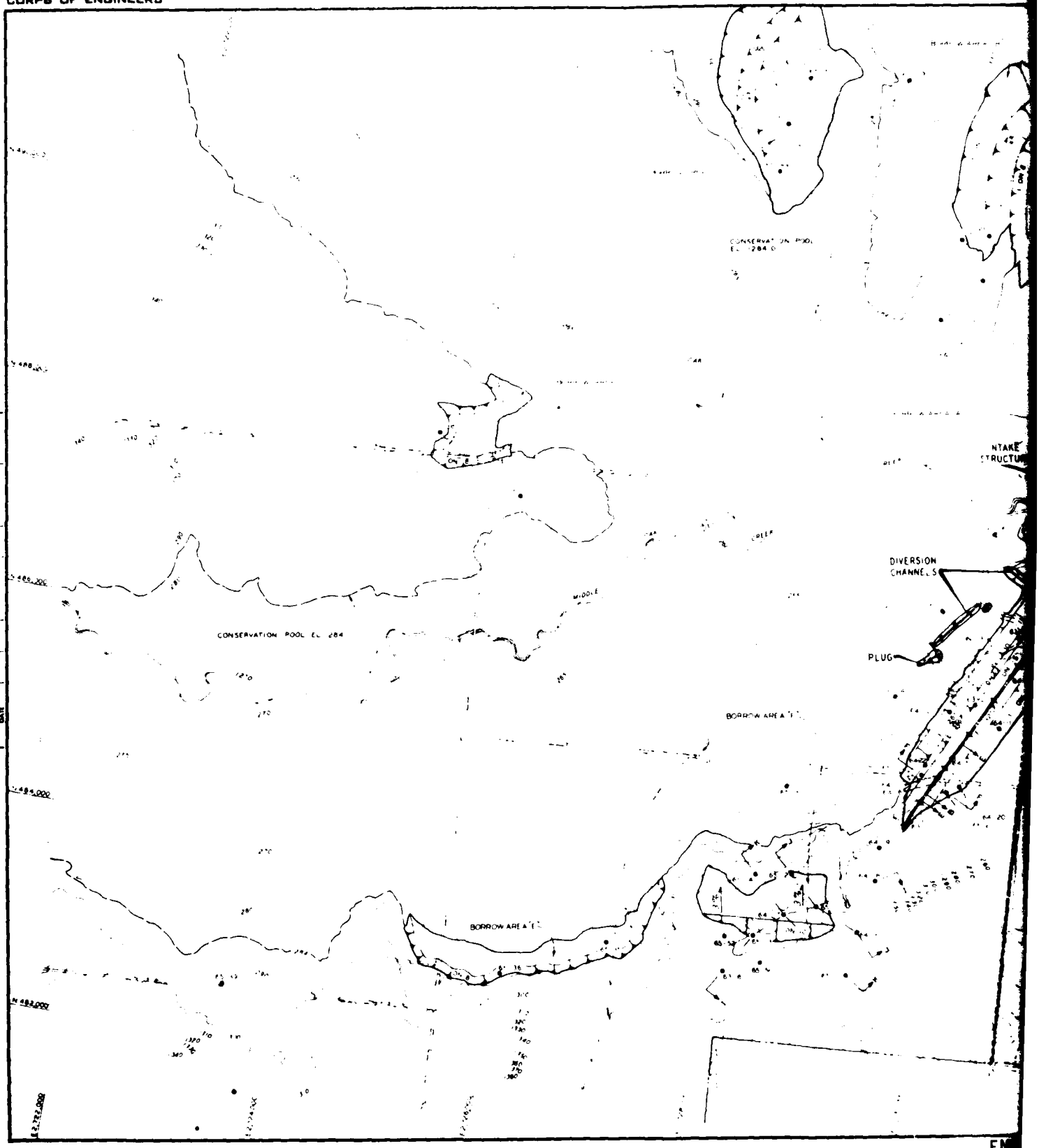
U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

SALT CREEK AND ITS TRIBUTARIES, NEBRASKA
BRANCHED OAK DAM AND LAKE
SITE NO. 18
EXCAVATION AND EMBANKMENT PLAN
SHEET 2

JULY 1966

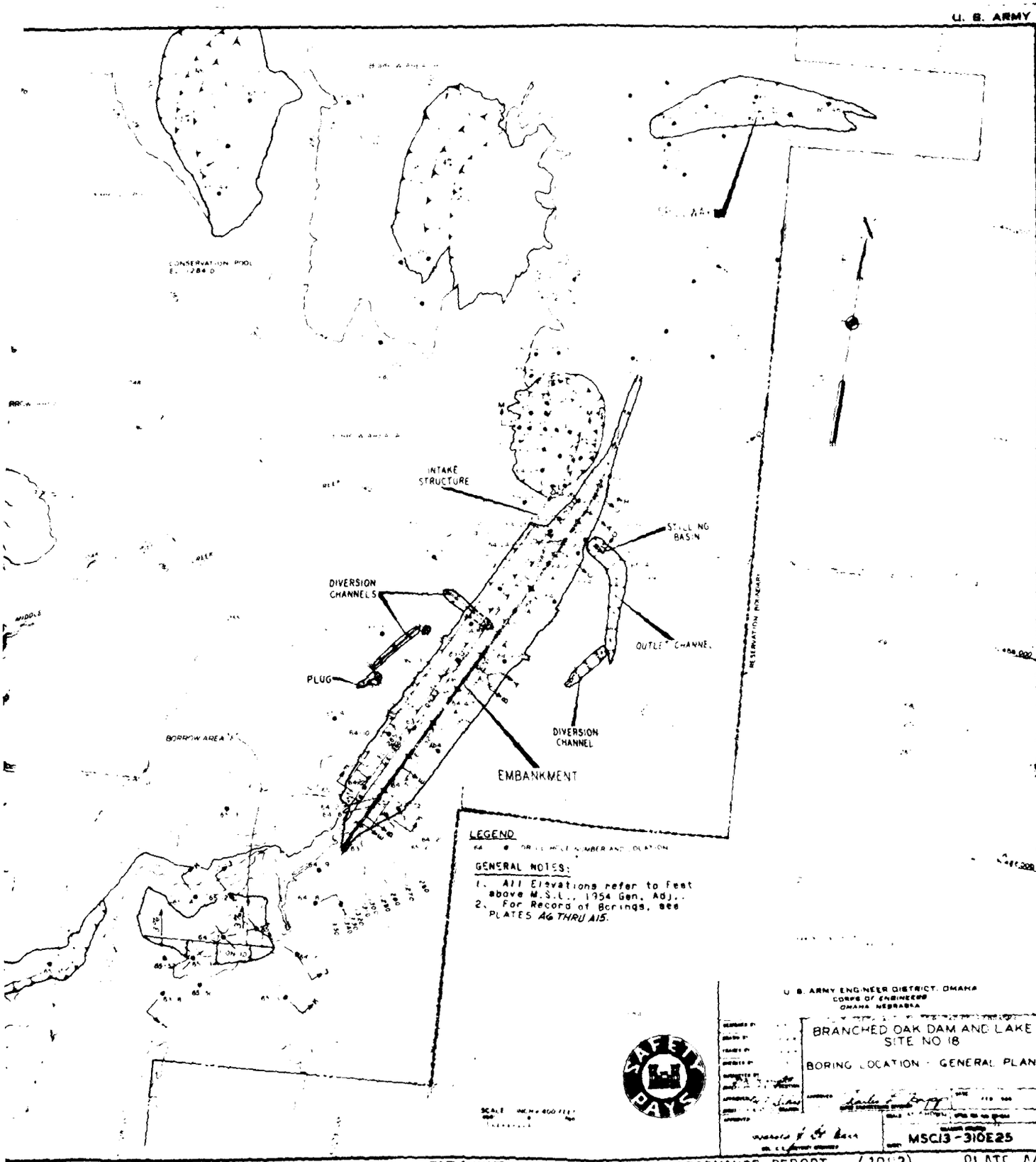
THIS PLAN ACCOMPANIES CONTRACT NO.
MODIFICATION NO.

CORPS OF ENGINEERS

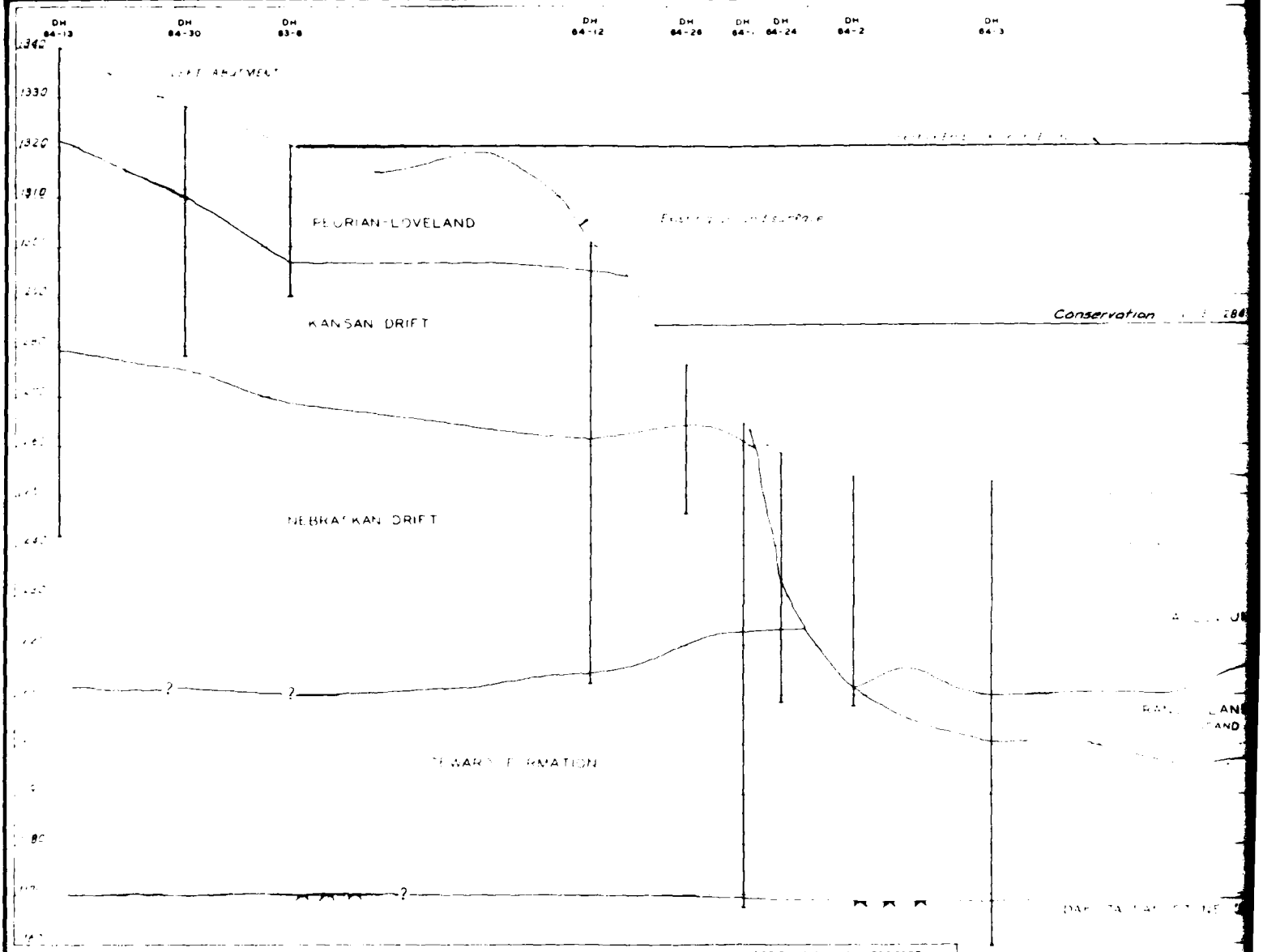


A 105 Mylar or a Paper Reproducible Record Copy Must Be Made Before Every Amendment and/or Modification

AMENDMENT	
DATE	
MODIFICATION	
DATE	

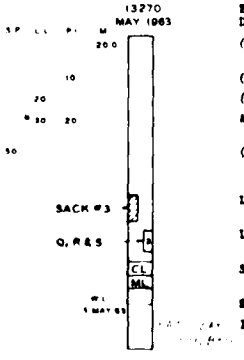

U. S. ARMY
CONSERVATION POOL
INTAKE STRUCTURE
STILLING BASIN
DIVERSION CHANNELS
PLUG
OUTLET CHANNEL
DIVERSION CHANNEL
EMBANKMENT
BORROW AREA
RESERVATION BOUNDARY
LEGEND
GENERAL NOTES:
1. All Elevations refer to Feet above M.S.L., 1954 Gen. Adj.
2. For Record of Borings, see PLATES A6 THRU A15.
SAFETY PAYS
U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA
BRANCHED OAK DAM AND LAKE
SITE NO 18
BORING LOCATION - GENERAL PLAN
MSC13-310E25

CORPS OF ENGINEERS



AGE	FORMATION	DESCRIPTIVE NOTES
QUATERNARY PLEISTOCENE	PEORIAN (LOESS) FORMATION AND LOVELAND (LOESS CLAY) FORMATION UNDIFFERENTIATED.	EOLIAN (WIND-BLOWN) DEPOSITS, ALTHOUGH THE LOWER MORE CLAYEY LOVELAND IS PARTIALLY AQUEOUS.
	KANSAN GLACIAL DRIFT	ALL SEDIMENTS DEPOSITED DURING KANSAN GLACIAL STAGE, PRIMARILY A PEBBLY-CLAY (TILL) AT THIS SITE.
	GRAND ISLAND FORMATION	SANDS AND GRAVELS DEPOSITED IN PRE-KANSAN VALLEYS BY EASTWARD FLOWING STREAMS FROM WEST OF THE TILL BORDER DURING KANSAN GLACIAL STAGE.
	AFTONIAN FORMATION	AN INTERGLACIAL DEPOSIT OF SILT, SAND AND CLAY DERIVED FROM THE OLDER NEBRASKAN DRIFT BY EROSION.
	NEBRASKAN GLACIAL DRIFT	TILL, PRIMARILY A PEBBLY CLAY DEPOSITED ON THE TERTIARY UPLANDS DURING THE NEBRASKAN GLACIAL STAGE. SILTS AND SANDS, GLACIALLY WORKED AND PARTIALLY GRADED. SOURCES PUSHED AHEAD OF THE ADVANCING GLACIER AND DEPOSITED IN THE TERTIARY LOWLANDS.
TERTIARY PLIOCENE	*SEWARD FORMATION*	SILTS AND CLAYS, USUALLY CALCAREOUS, DEPOSITED PRIMARILY IN THE LOWLANDS OF THE ROUGH CRETACEOUS TOPOGRAPHY.
CRETACEOUS	DAKOTA FORMATION	PRIMARILY SANDSTONES AND SHALES. ONLY SANDSTONE ENCOUNTERED AT THE SITE.

LEGEND



Drill Hole Number
Elevation at Top of Ground
Date of Boring

(M) Percent of moisture at time of drilling as determined by Laboratory Test.

(P.I.) Plasticity Index

(L.L.) Liquid Limit

Atterberg Limits based on visual comparison with similar sample actually tested.

(S.P.) Standard Penetration in blows per foot required to drive a 2" O.D. sampler by dropping a 140 lb. hammer 30 inches

Location and identifying number of sack sample taken.

Location and identifying number of undisturbed sample taken and the type of test performed.

Soil Classification based on Atterberg Limits, Mechanical Analysis and Visual Comparison.

Static water level and date recorded.

Inspector's field description of soil encountered.

CLASSIFICATION OF SOILS:

CH	FAT AND SANDY FAT CLAY
CL	LEAN, SANDY, SILTY AND
ML	SILT, SANDY AND CLAYEY
SM	SILTY SAND & SILTY
SC	CLAYEY SAND
SP	SAND OR GRAVELLY SAND
SW	SAND OR GRAVELLY SAND
GM	SILTY SANDY GRAVEL

GENERAL NOTES:

1. All Elevations shown
N.G.L., 1955 General
2. For location of Bor

EMBA

DH 64-28 DH 64- DH 64-24 DH 64-2 DH 64-3 DH 64-4 DH 64- DH 64 DH 64-6

Conservation

ALLUVIAL CLAY

GRAND ISLAND FORMATION
(SAND & GRAVEL)

DAKOTA SANDSTONE BEDROCK

HORIZ SCALE 1 INCH = 200 FEET

LEGEND

D H 63 /
13270
MAY 1963

Drill Hole Number
Elevation at Top of Ground
Date of Boring

(M) Percent of moisture at time of drilling as determined by Laboratory Test.

(P.I.) Plasticity Index

(L.L.) Liquid Limit

Atterberg Limits based on visual comparison with similar sample actually tested.

(S.P.) Standard Penetration in blows per foot required to drive a 2" O.D. sampler by dropping a 140 lb. hammer 30 inches

Location and identifying number of core sample taken.

Location and identifying number of undisturbed sample taken and the type of test performed.

Soil Classification based on Atterberg Limits, Mechanical Analysis and Visual Comparison.

Static water level and date recorded.

Inspector's field description of soil encountered.

CLASSIFICATION OF SOILS:

CH	FAT AND SANDY FAT CLAY
CL	LEAN, SANDY, SILTY AND GRAVELLY CLAY
ML	SILT, SANDY AND CLAYEY SILT
SM	SILTY SAND & SILTY GRAVELLY SAND
SC	CLAYEY SAND
SP	SAND OR GRAVELLY SAND, POORLY GRADED
GW	SAND OR GRAVELLY SAND, WELL GRADED
GM	SILTY SANDY GRAVEL

GENERAL NOTES:

1. All Elevations shown refer to feet above M.S.L., 1935 General Adjustment.
2. For Location of Borings, see plate A4.

SAFETY DAYS

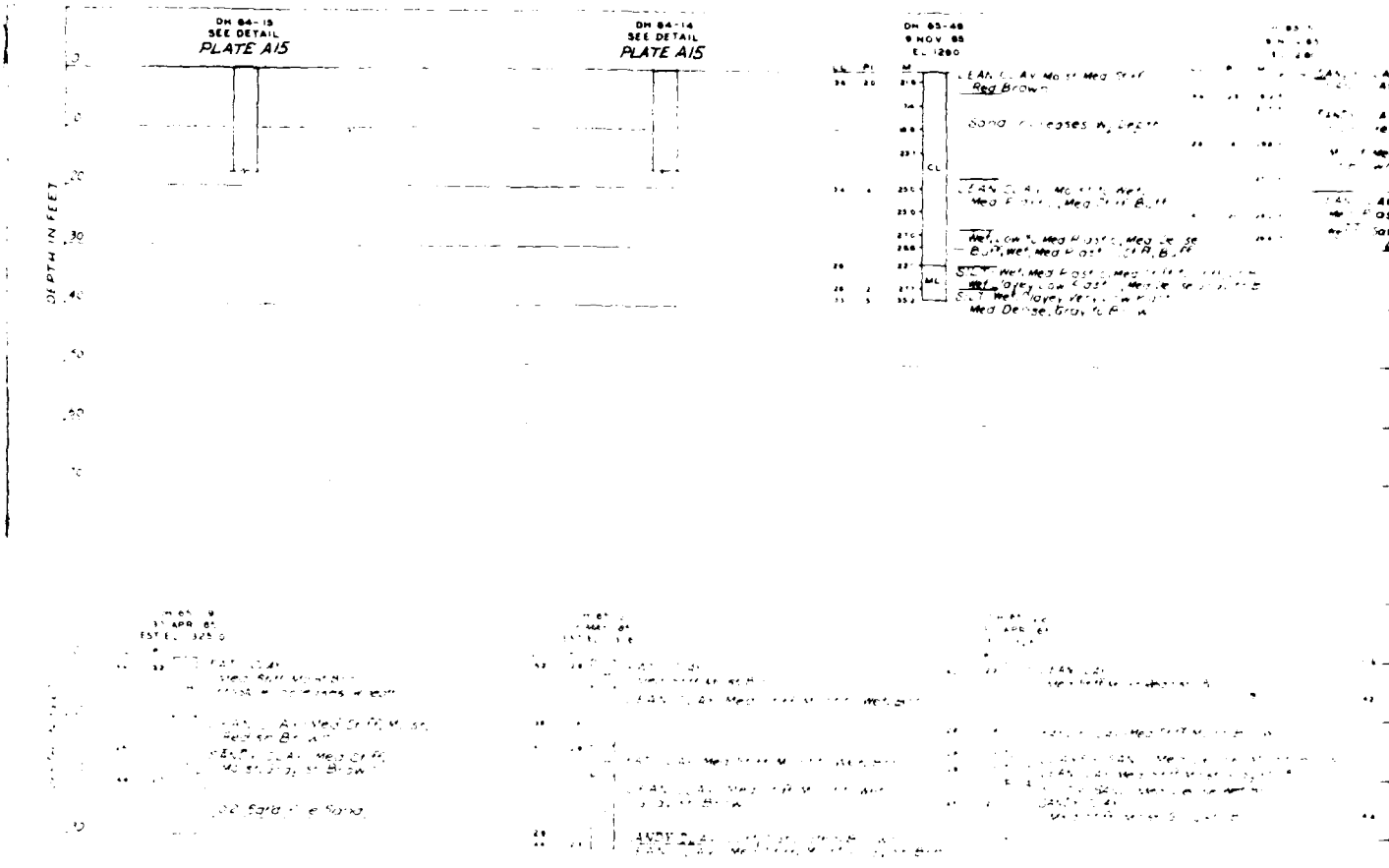
U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

SALT CREEK AND ITS TRIBUTARIES, NEBRASKA

BRANCHED OAK DAM & RESERVOIR

GENERAL SOIL & GEOLOGIC PROFILE
ALONG EMBANKMENT CENTERLINE

THIS PLAN ACCOMPANIES CONTRACT NO DA-25-066-[illegible]
MODIFICATION NO



DESCRIPTIVE NOTES:

1. The data shown graphically and by symbol for each respective boring represents the actual geologic features observed and logged at the location given on the drawings. While the borings are representative of subsurface conditions at their respective locations and for their respective vertical reaches, local variations characteristic of the subsurface materials of this region are anticipated and, if encountered, such variations will not be considered as differing "materially" within the purview of Article IV of the contract.
2. Descriptions of material, based on visual inspection in the field, are shown to the right of the graphic log.
3. Absence of water readings in the Graphic Log of any boring is not necessarily to be construed that ground water will not be encountered in excavation at that location.
4. Information on material has been condensed in the Graphic Logs. Additional information is shown on field logs, which may be inspected at the Omaha District Office.
5. Undisturbed sampling was accomplished with a rotary drill using a Shelby tube sampler. Disturbed samples were obtained with a percussion type drill using an open end drive barrel.

ABBREVIATIONS

Brown	Brn.	Mod
Calcareous	Calc.	Occ
Carbonaceous	Carb.	Pre
Dark	Dk.	Sat
Gray	Gry.	Soft
Light	Lt.	Ver
Material	Mat'l.	Wit

CLASSIFICATION OF SOILS:

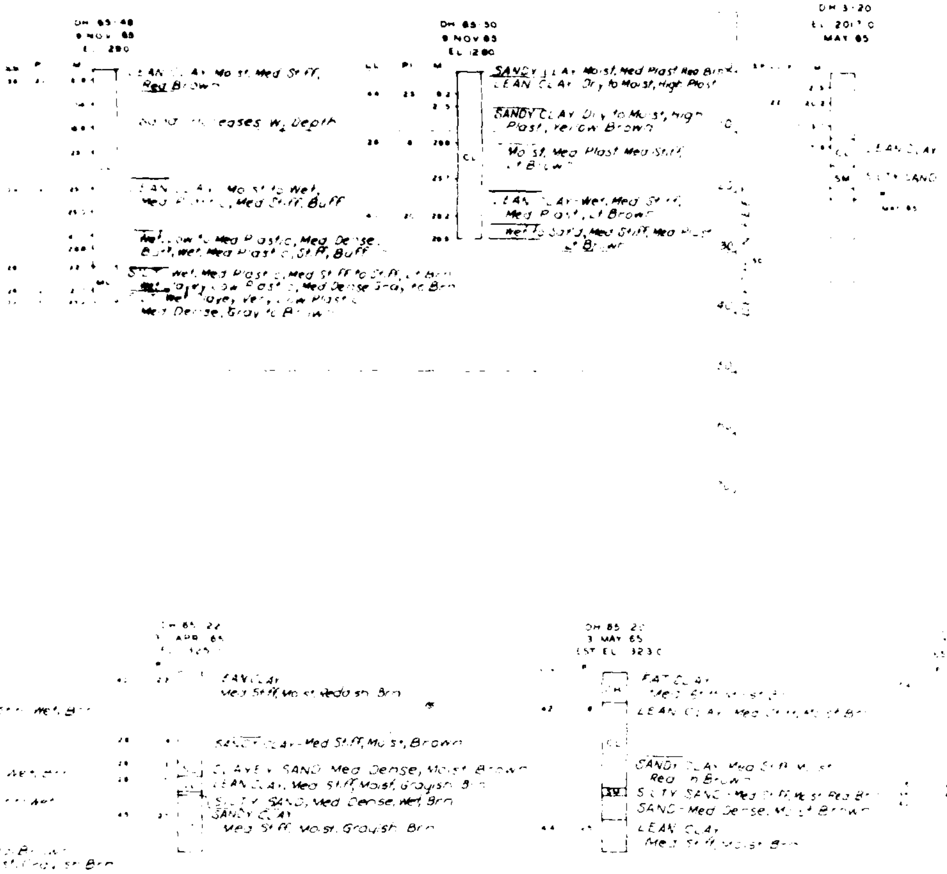
SW	SAND OR GRAVELLY SAND
SP	SAND OR GRAVELLY SAND
SM	SILTY SAND OR SILTY G
SC	CLAYEY SAND OR CLAYEY
ML	SILTS, SANDY SILTS, OR CLAYEY SILTS
CL	LEAN CLAYS, SANDY CL OR GRAVELLY CLAYS
CH	FAT CLAYS

EMB

U. S. ARMY

LEGEND:

DH 3-20 / EL 2017.0 / MAY 65	Drill Hole Number M.S.L. Elevation Date of drilling
	(M) Percent of moisture at time of drilling determined by laboratory test.
	(L.L.) Liquid Limit
	(P.I.) Plasticity Index
CL LEAN CLAY / SM SILTY SAND	Soil classification based on laboratory tests, Atterberg Limits, Mechanical Analysis and Visual Examination.
MAY 65	Water Level and date of observation, established by measurement in open hole
	Proposed excavation limits this contract
	(S.P.) Standard Penetration in blows per foot required to drive a 2" O.D. sampler by dropping a 140 lb. hammer 30 inches



n graphically and by symbol for boring represents the actual es observed and logged at the on the drawings. While the presentative of subsurface con- r respective locations and for e vertical reaches, local var- eristic of the subsurface mat- region are anticipated and, if ch variations will not be con- ering "materially" within the icle IV of the contract.

of material, based on visual the field, are shown to the right log.

ater readings in the Graphic Log is not necessarily to be con- ound water will not be en- cavation at that location.

en material has been condensed Logs. Additional information eld logs, which may be inspected istrict Office.

sampling was accomplished with using a Shelby tube sampler. les were obtained with a per- rill using an open end drive

ABBREVIATIONS

Brown	Brn.	Medium	Med.
Calcareous	Calc.	Occasional	Occ.
Carbonaceous	Carb.	Plasticity	Plast.
Dark	Dk.	Saturated	Sat.
Gray	Gry.	Scattered	Scat.
Light	Lt.	Very	V
Material	Mat'l.	With	W

CLASSIFICATION OF SOILS:

SW	SAND OR GRAVELLY SAND, WELL GRADED
SP	SAND OR GRAVELLY SAND, POORLY GRADED
SM	SILTY SAND OR SILTY GRAVELLY SAND
SC	CLAYEY SAND OR CLAYEY GRAVELLY SAND
ML	SILTS, SANDY SILTS, GRAVELLY SILTS OR CLAYEY SILTS
CL	LEAN CLAYS, SANDY CLAYS, SILTY CLAYS OR GRAVELLY CLAYS
CH	FAT CLAYS

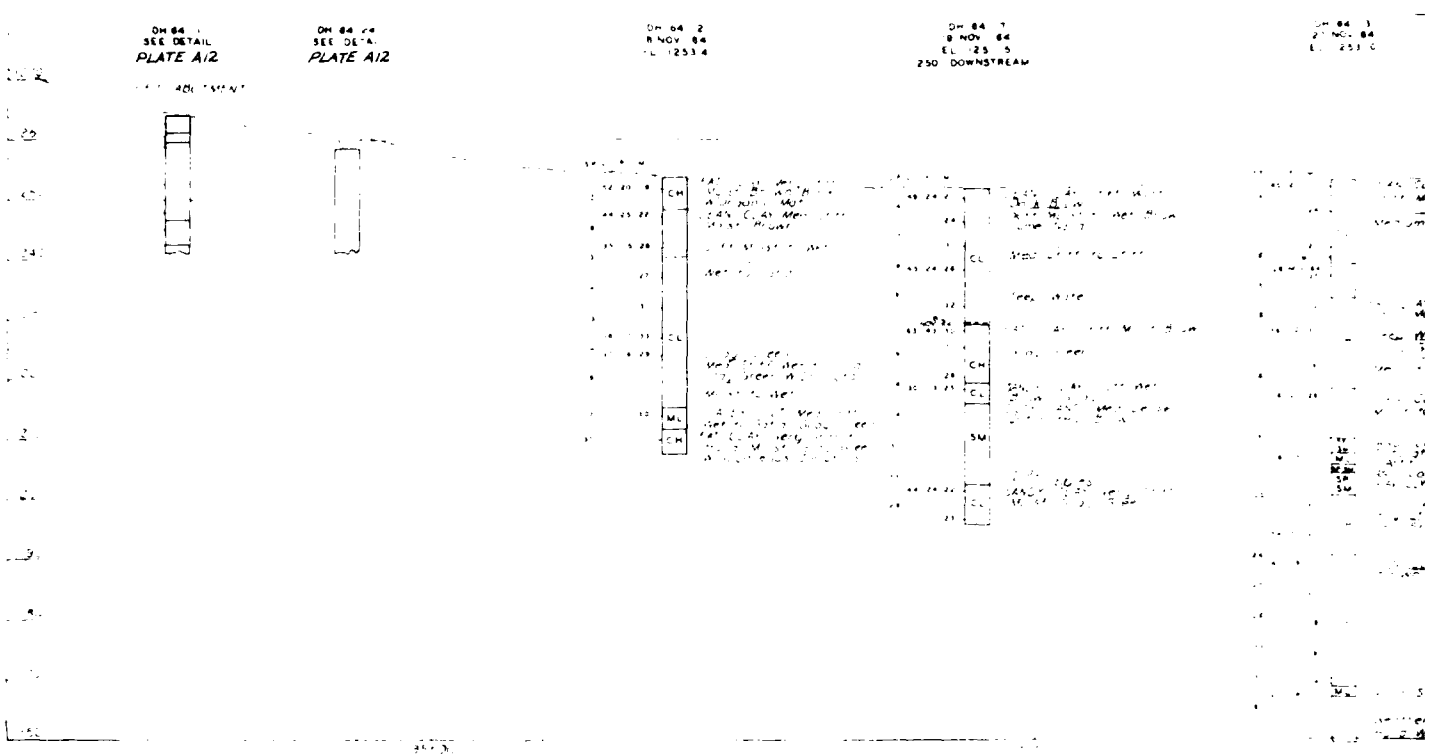
GENERAL NOTES:

1. All elevations shown refer to feet above M.S.L., 1954 General Adjustment.
2. For location of Borings, see PLATE A4.

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

BRANCHED OAK DAM AND LAKE
SITE NO 10
BORING LEGEND AND
RECORD OF BORINGS
LEFT ABUTMENT AREA

MSC13-310E26



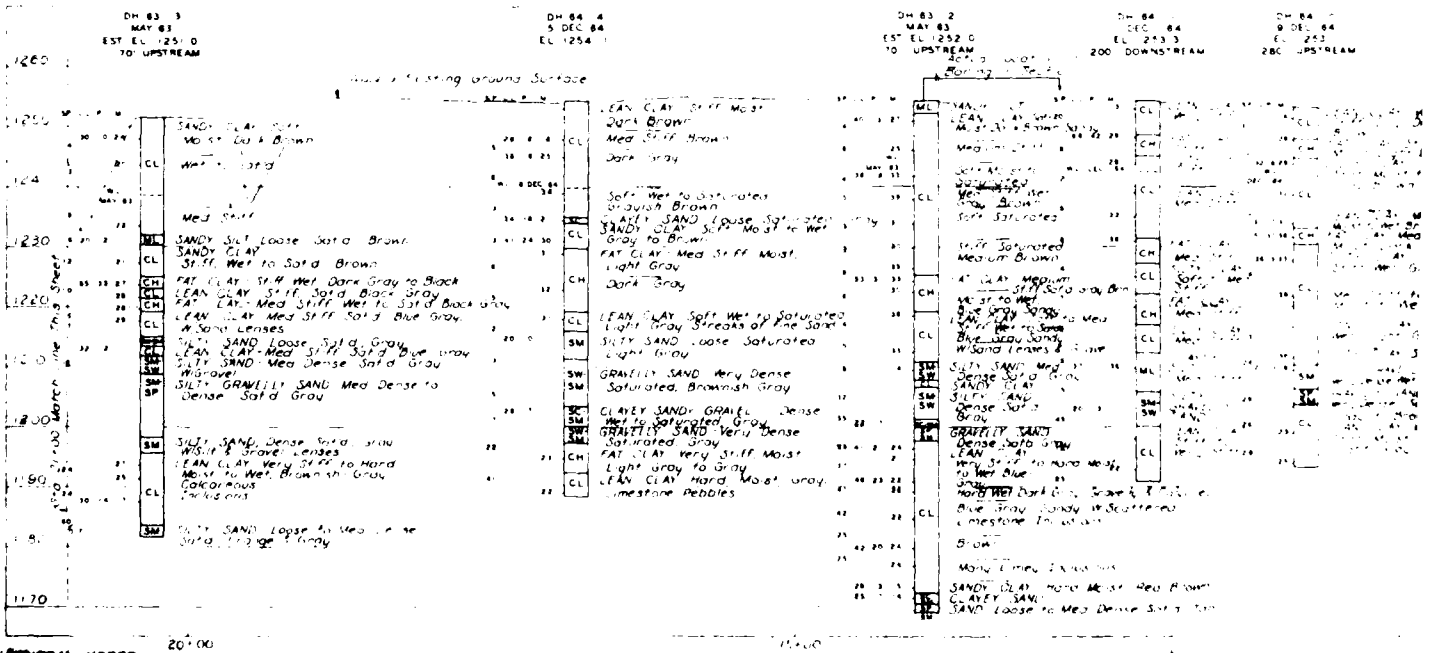
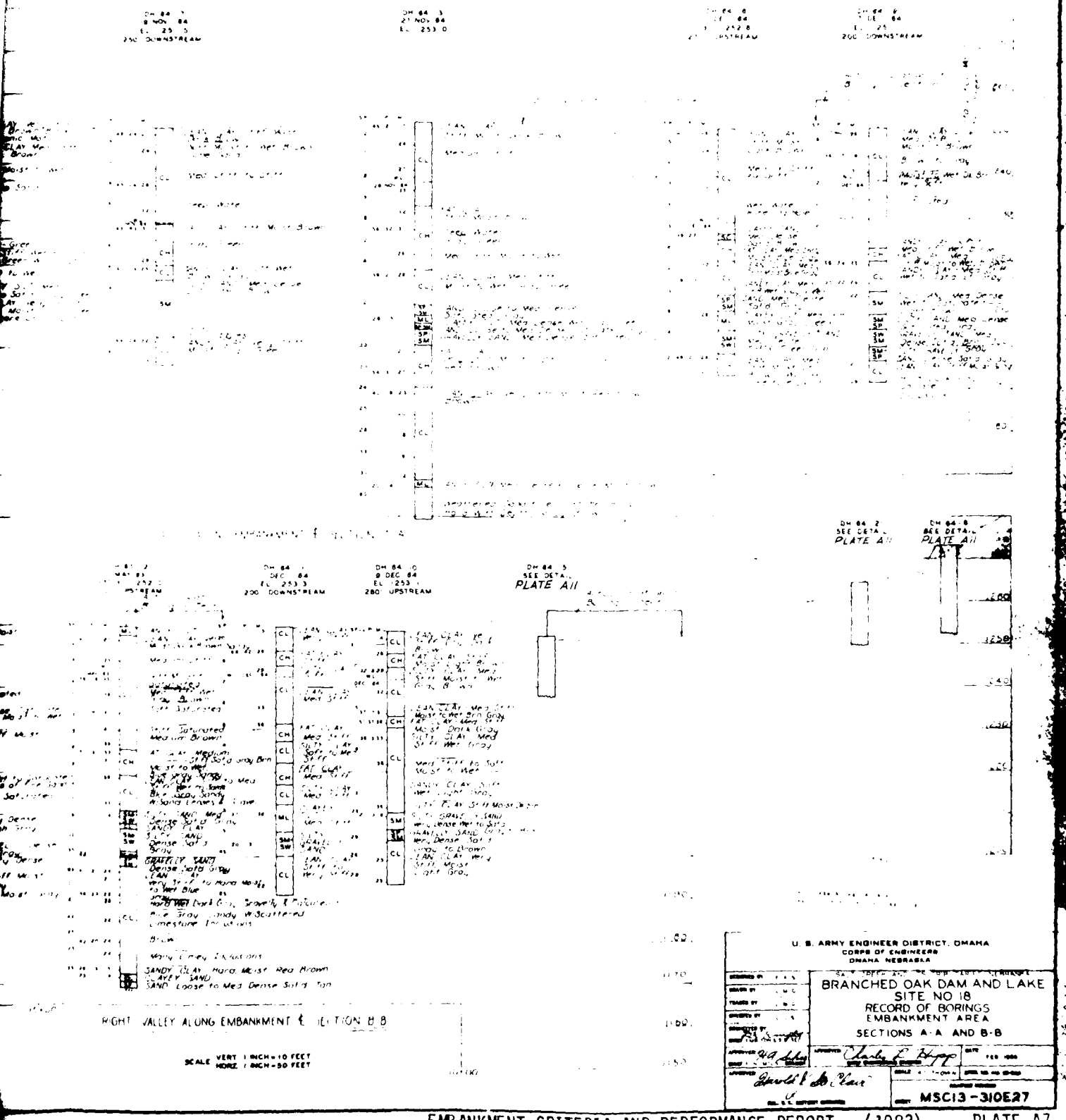


DIAGRAM NOTES:

1. All elevations shown refer to feet above M.S.L., 1954 Gen. Adj.
2. For Boring Legend, Classification of Soils and Descriptive Notes, see PLATE A6.
3. For Location of Borings, see PLATE A4.

EMBA

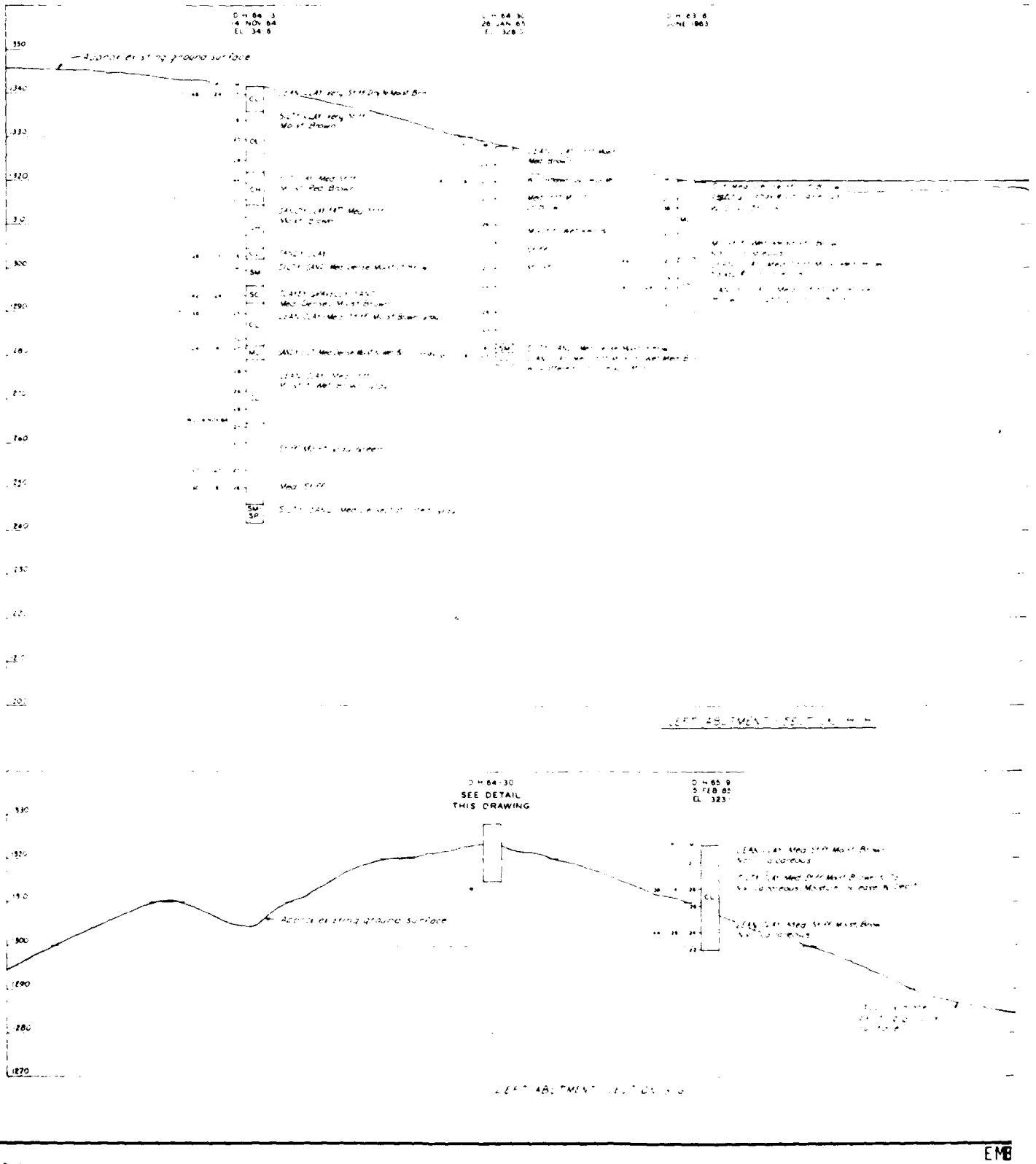


U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA NEBRASKA

BRANCHED OAK DAM AND LAKE
SITE NO 18
RECORD OF BORINGS
EMBANKMENT AREA
SECTIONS A-A AND B-B

MSC13-310E27

CORPS OF ENGINEERS



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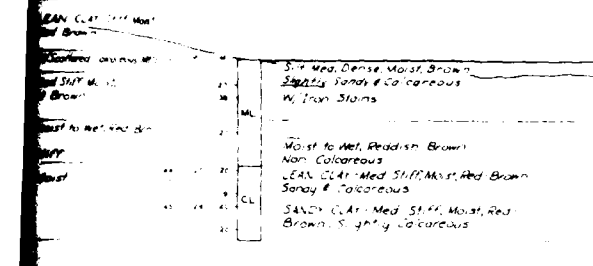
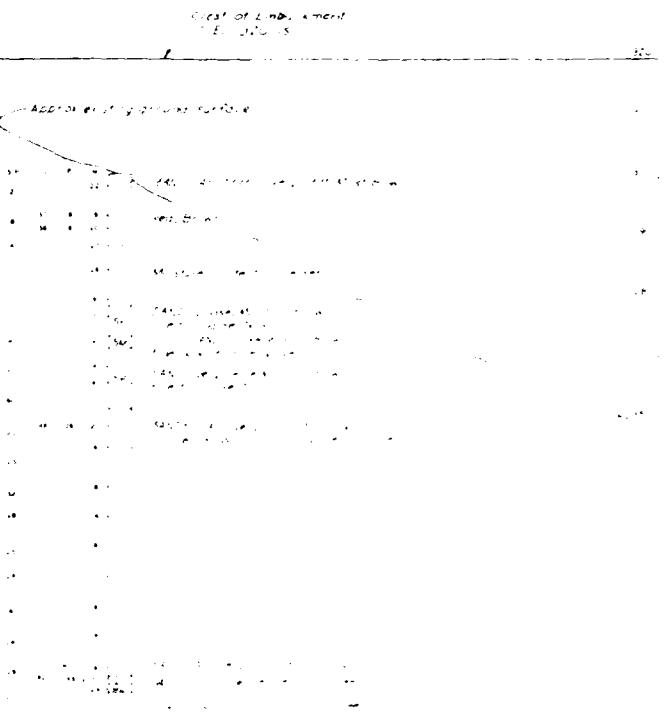
AMENDMENT DATE

MODIFICATION DATE

EM8

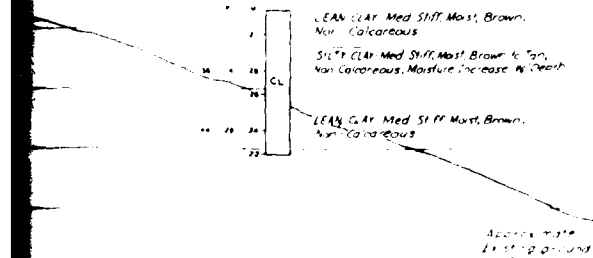
D M 63 8
JUNE 1983





LEFT ABUTMENT SECTION H-H

D M 85 8
S FEB 85
EL 1323



ABUTMENT SECTION G-G

GENERAL NOTES

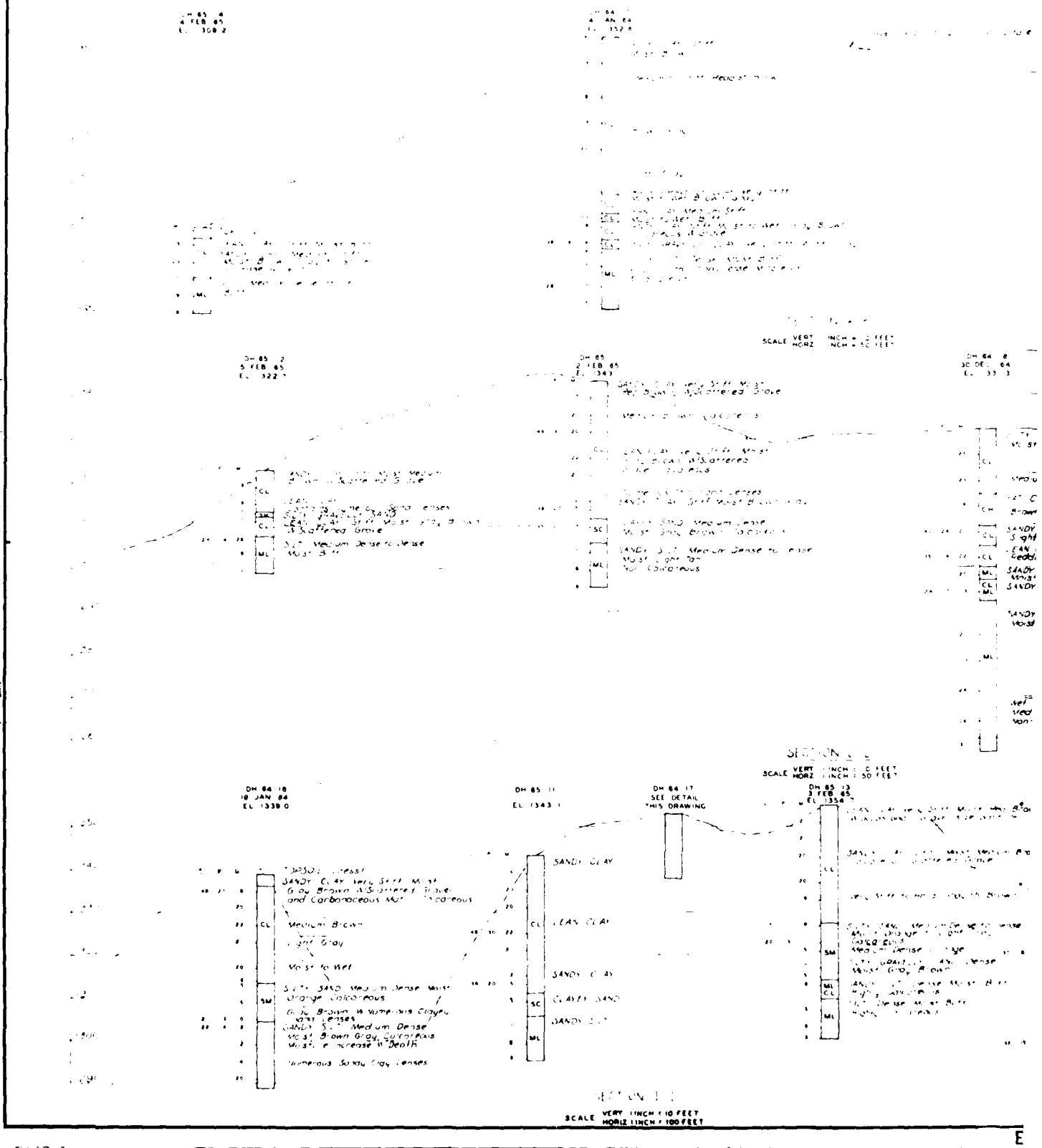
1. All elevations shown refer to feet above [illegible] Datum, Adj.
2. For Boring Legend, Classification of Soils and Descriptive Notes, see PLATE A6.
3. For Location of Borings, see PLATE A4.

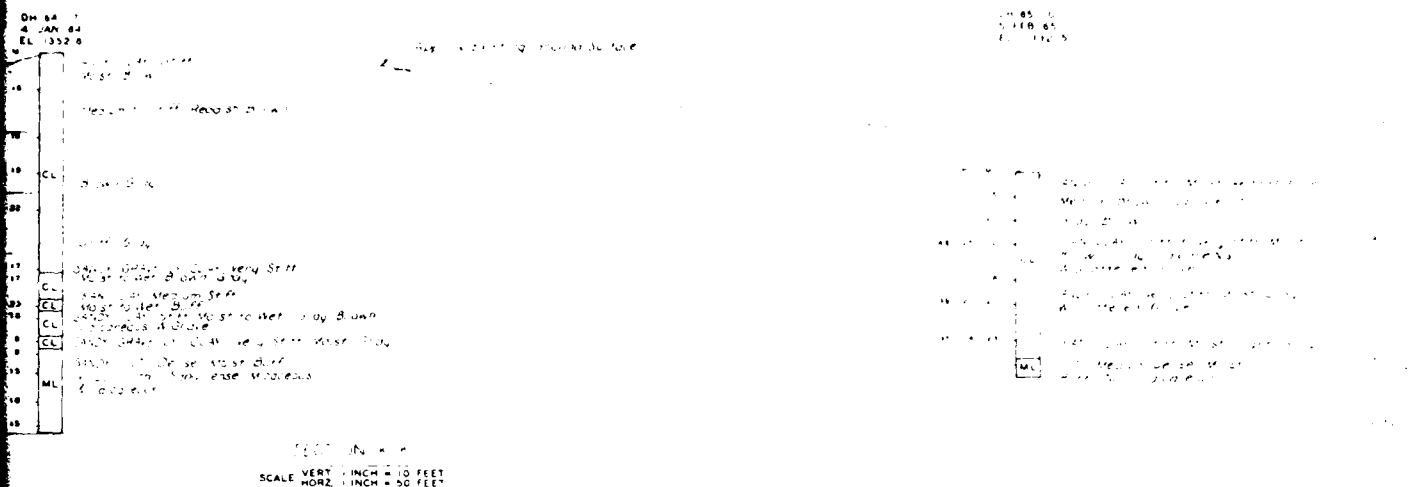
U. S. ARMY ENGINEER DISTRICT OMAHA
CORPS OF ENGINEERS
OMAHA NEBRASKA

BRANCHED OAK DAM AND LAKE
SITE NO. 8
LEFT ABUTMENT AREA

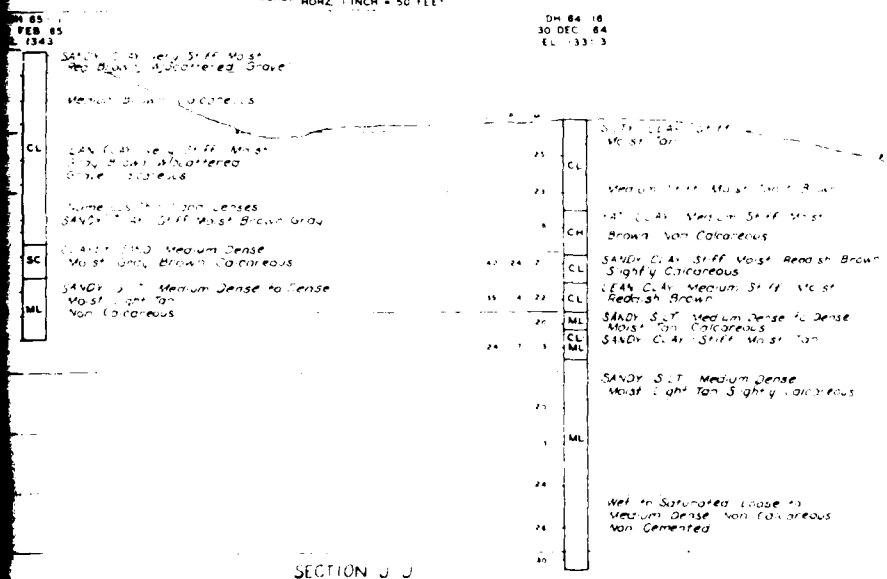
MSC13-310E 28

EMBANKMENT CRITERIA AND PERFORMANCE REPORT (1983) PLATE A8

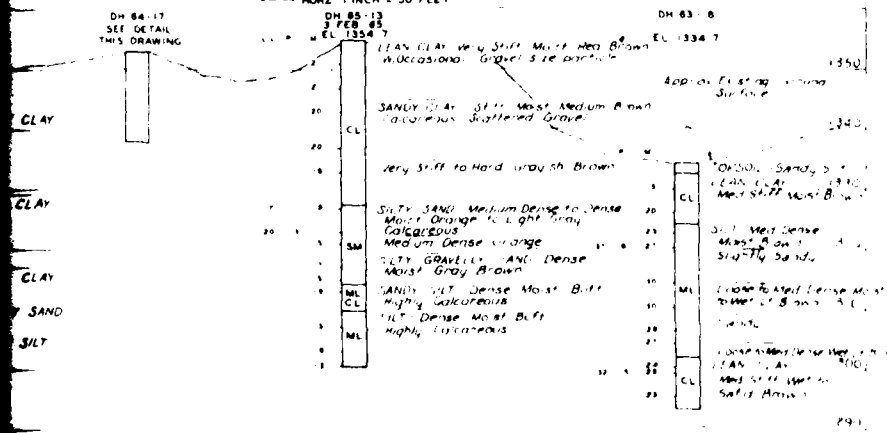




SECTION K K
SCALE VERT 1 INCH = 10 FEET
HORZ 1 INCH = 50 FEET



SECTION J J
SCALE VERT 1 INCH = 10 FEET
HORZ 1 INCH = 50 FEET



SECTION I I
VERT 1 INCH = 10 FEET
HORZ 1 INCH = 100 FEET

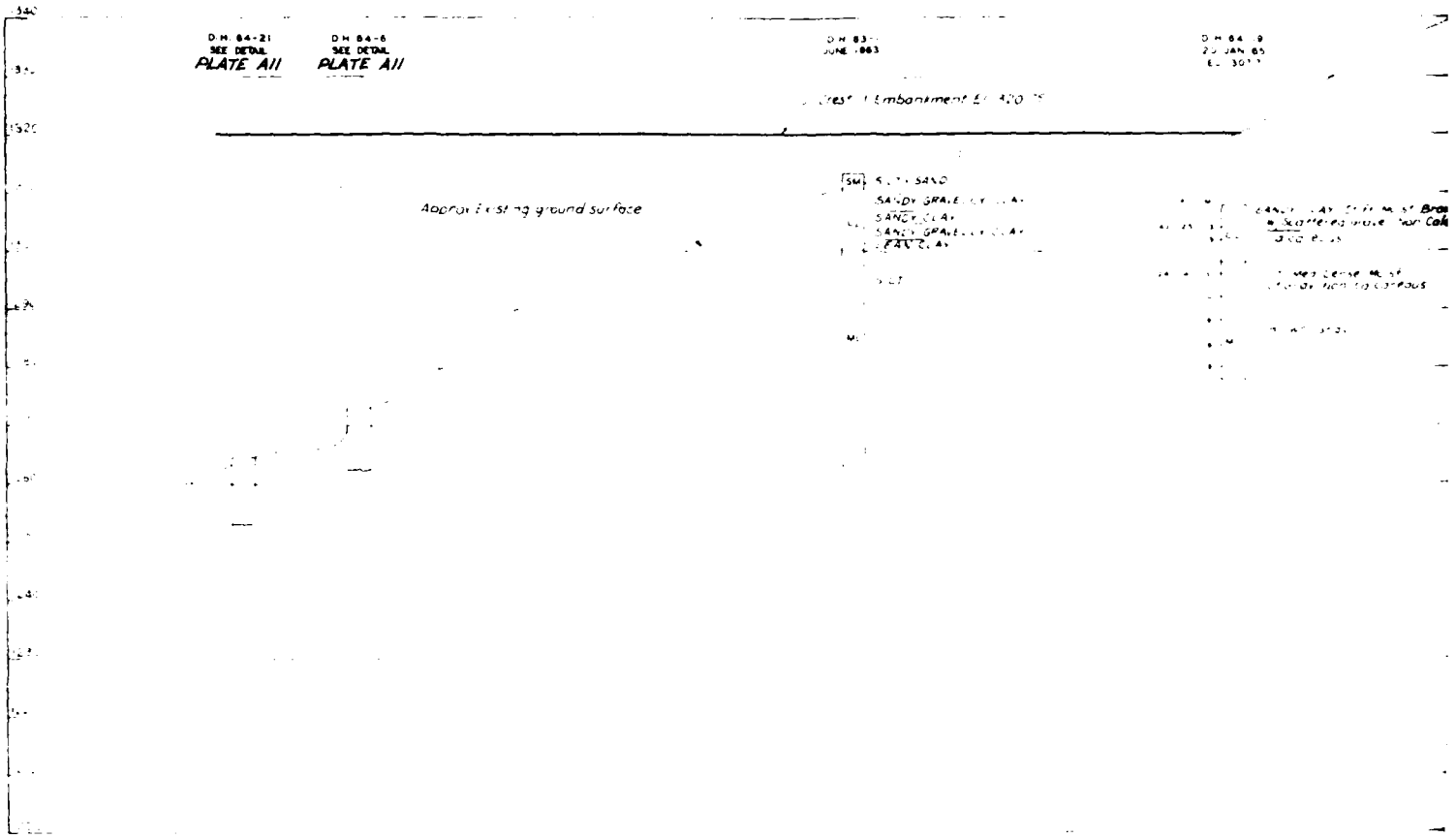
GENERAL NOTES:

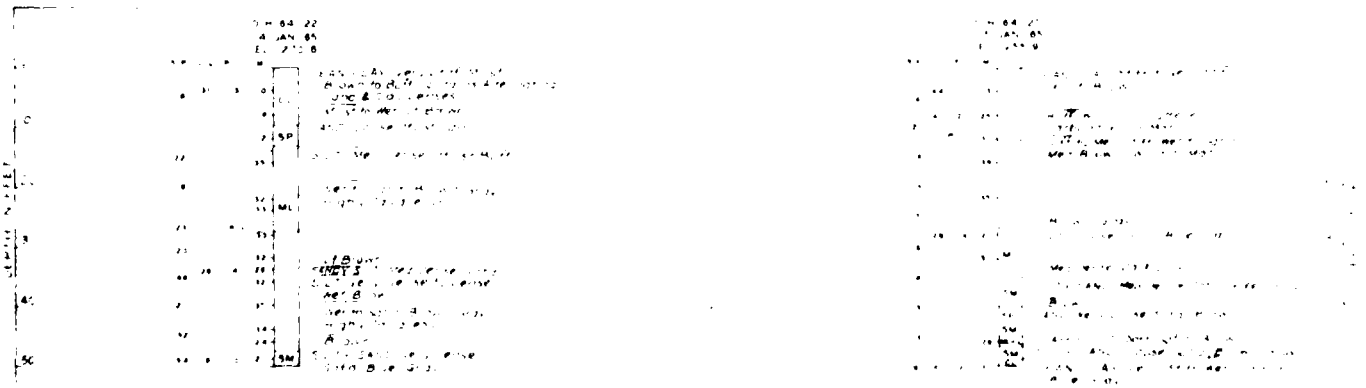
1. All elevations shown refer to feet above M.S.L., 1954 Gen. Adj.
2. For Boring Legend, Classification of Soils and Descriptive Notes, see PLATE A6.
3. For Location of Borings, see PLATE A4.

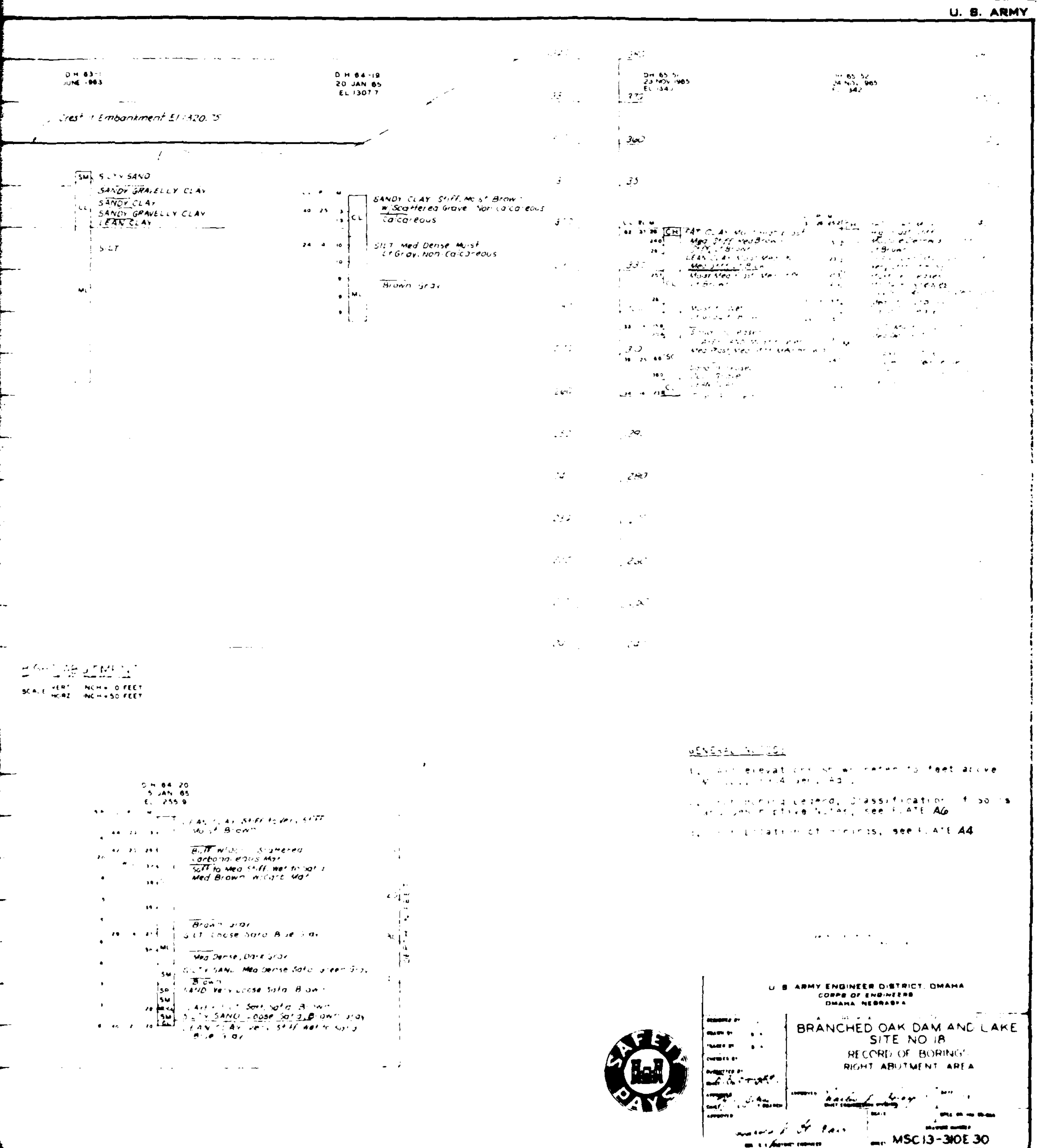
U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

BRANCHED OAK DAM AND LAKE
SITE NO 18
RECORD OF BORINGS
RIGHT ABUTMENT AREA
SECTIONS I I, J J AND K K

MSC13-310E29

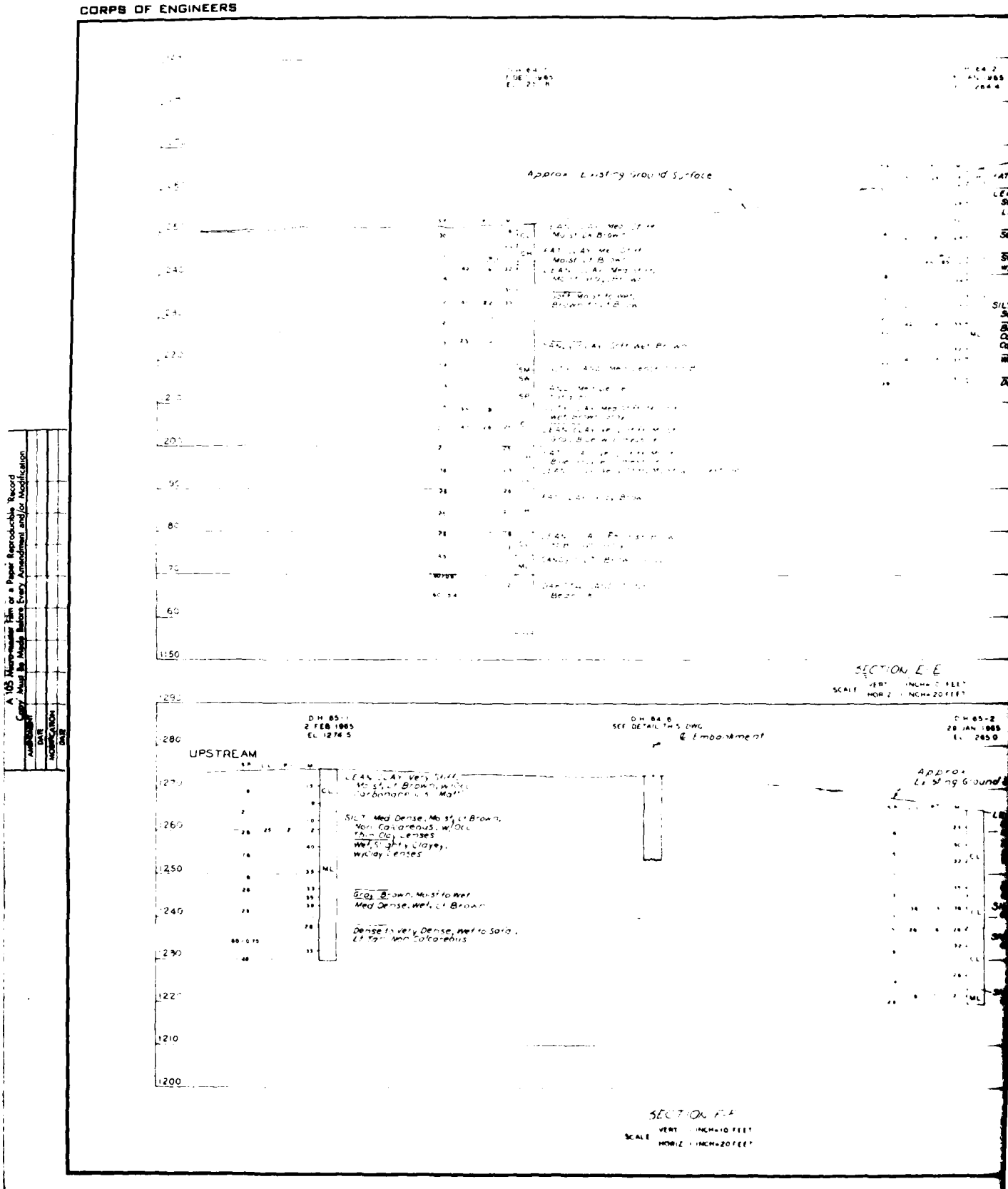

D-M 64-21
SEE DETAIL
PLATE A11
D-M 64-6
SEE DETAIL
PLATE A11
D-M 83-
JUNE 1883
D-M 64-9
23 JAN 65
Approx existing ground surface
SAND
SANDY GRAVEL
SANDY CLAY
SANDY GRAVEL
FAT CLAY

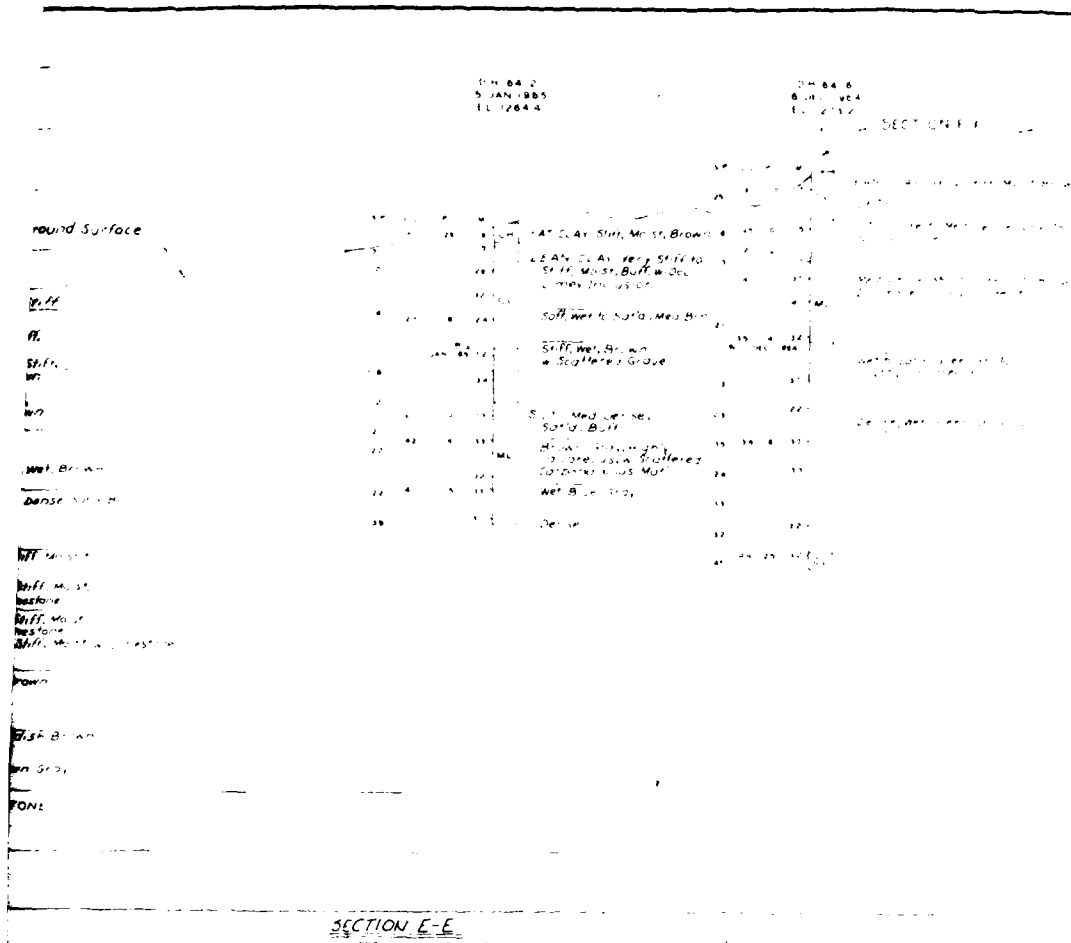




EMBANKMENT CRITERIA AND PERFORMANCE REPORT (1983) PLATE A10

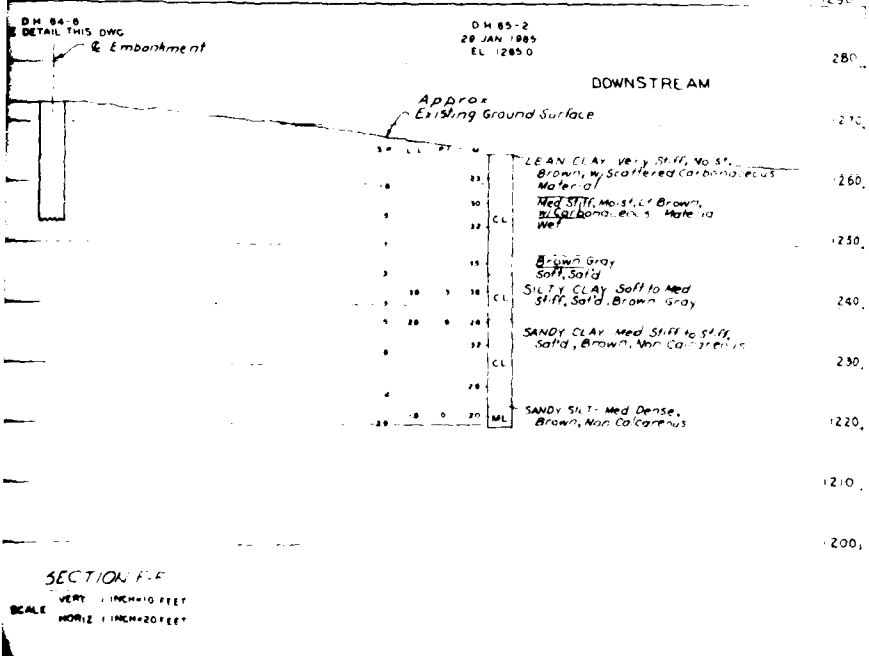
CORPS OF ENGINEERS





SECTION E-E

SCALE VERT 1 INCH=10 FEET
HORIZ 1 INCH=20 FEET



SECTION F-F

SCALE VERT 1 INCH=10 FEET
HORIZ 1 INCH=20 FEET

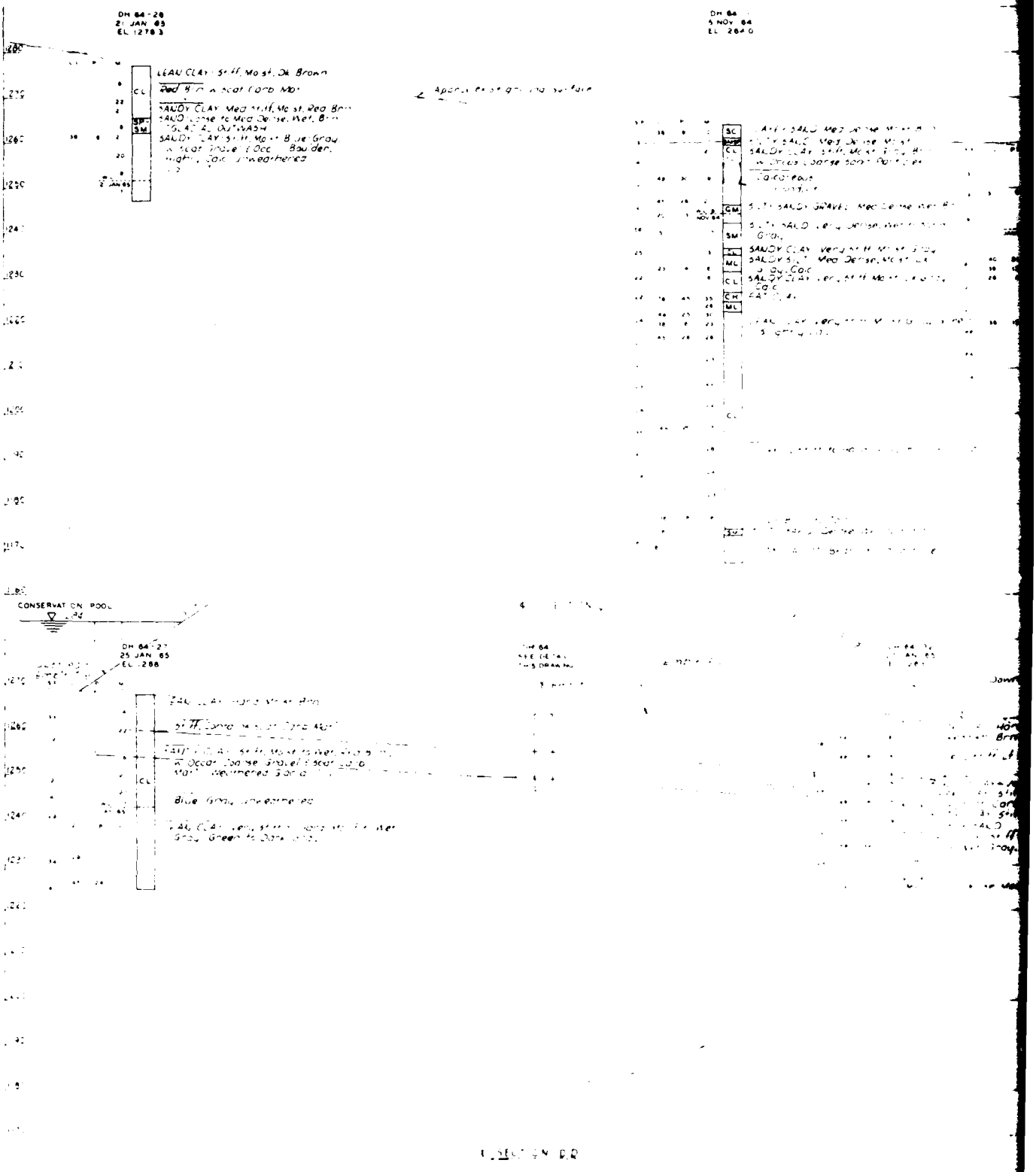
General Notes:

1. All elevations shown refer to feet above m.s.l., 1954 Gen. Adj.
2. For complete Legend, Classification of Soils and Descriptive Notes, see PLATE A6.
3. For Location of Borings, see PLATE A4.

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

BRANCHED OAK DAM AND LAKE
SITE NO 18
RECORD OF BORINGS
RIGHT ABUTMENT AREA
SECTIONS E-E AND F-F

MSCI3-310E31



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AMENDMENT	DATE
MODIFICATION	DATE

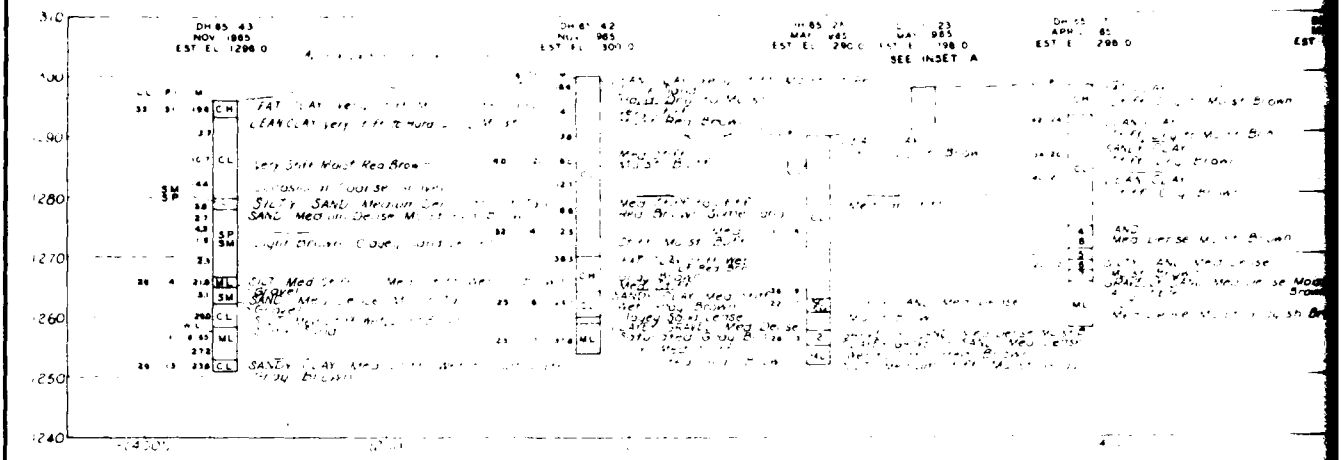
SECTION D-D

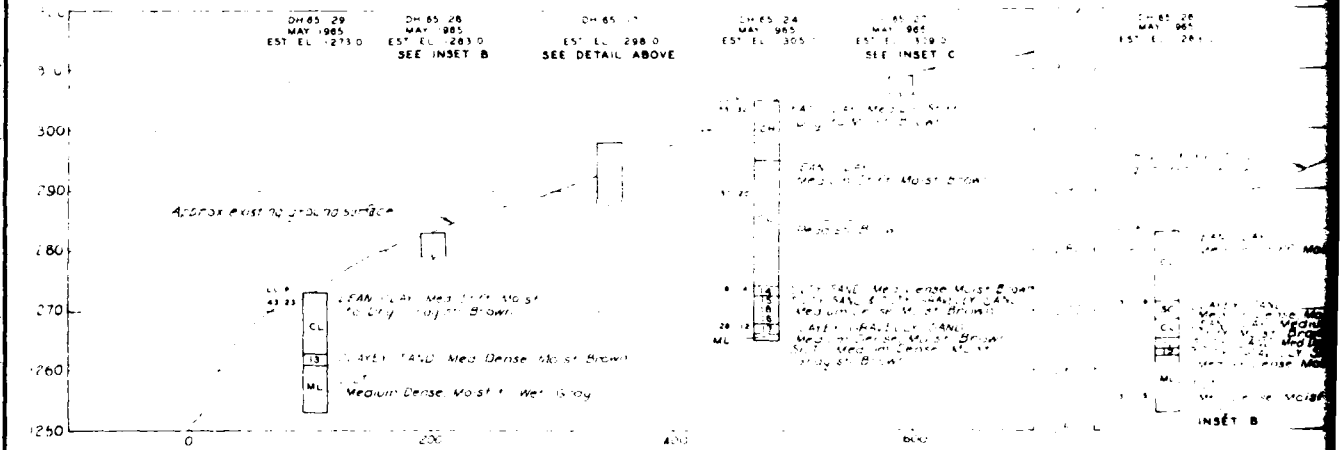
U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

BRANCHED OAK DAM AND LAKE
SITE NO. 8
SALINE AND LANCASTER COUNTIES
NEBRASKA
SECTIONS A-A

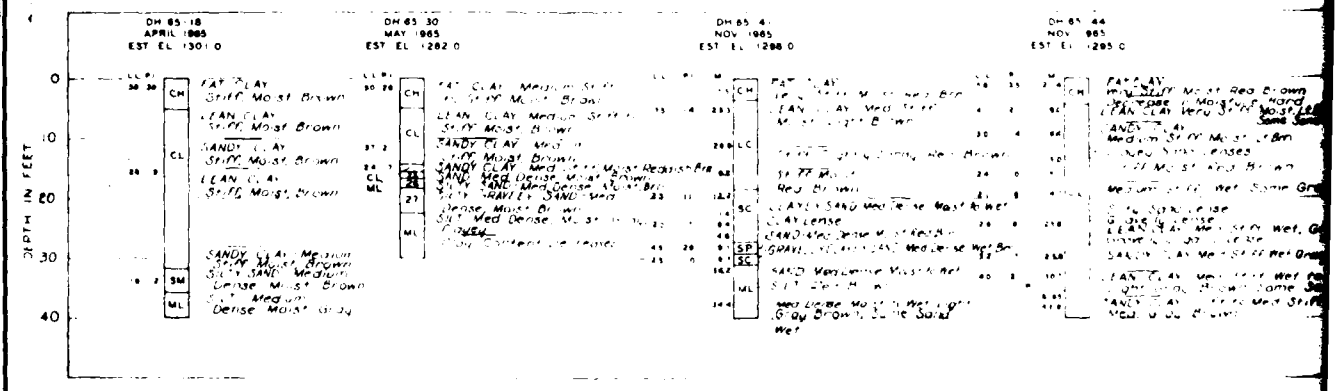
MSC13-310E32

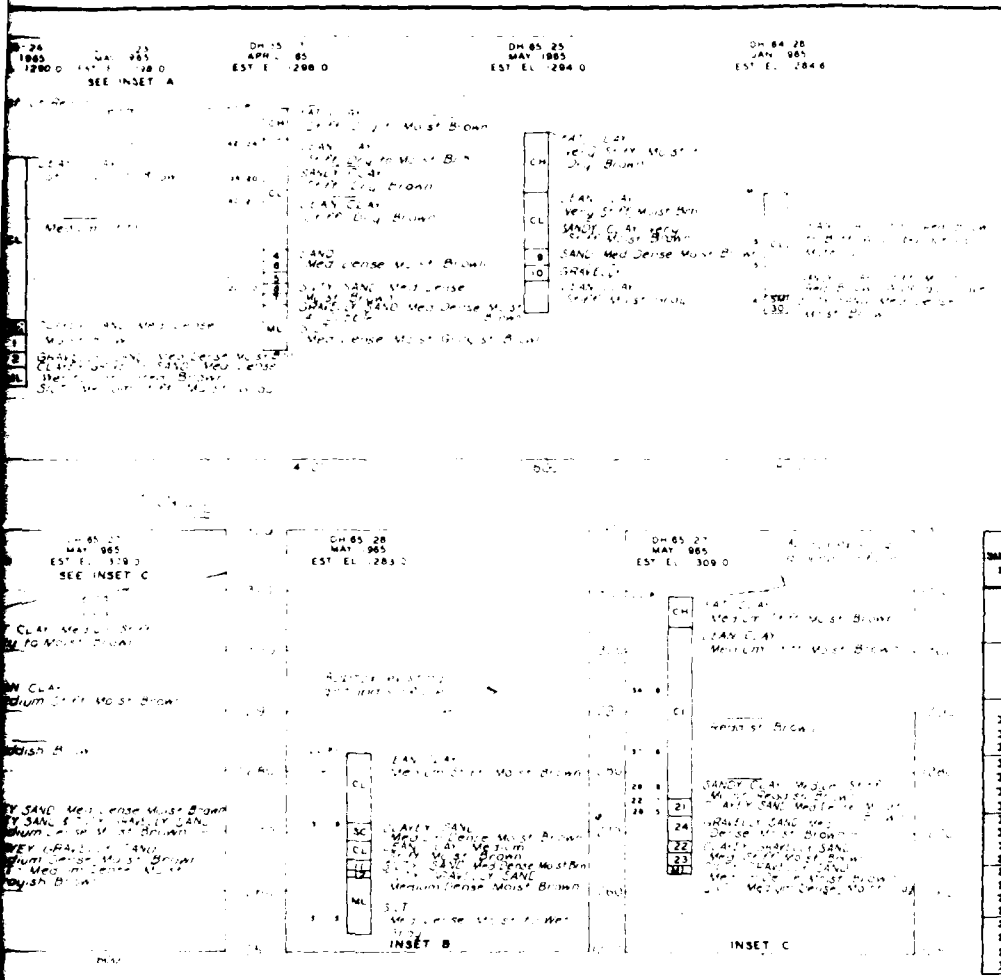
CORPS OF ENGINEERS





SECTION M-M





COARSE GRAINED SOIL CLASSIFICATION

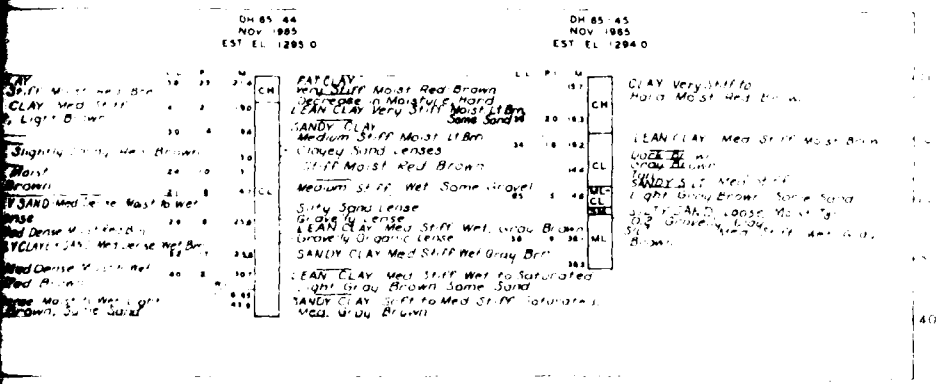
SAMPLE NO.	PLASTICITY (ATT. LIM.) L.L.	P.I.	GRADING (CUMULATIVE PERCENTS PASSING) U.S. STANDARD SIEVE SIZES FINES 200	SAND 40	SAND 10	GRAVEL 1 1/2 in.	GRAVEL 3 in.	CLASSIFICATION
1			6	13	49	62	83	100	GRAVELLY SAND SP-SM
2	28	23	12	22	46	56	78	100	CLAYEY GRAVELLY SAND SC-GC
3			30	71	99	100			CLAYEY SAND SC
4			8	34	81	93	100		SAND SW-SM
5			4	93	100				SAND SP
6	20	2	43	99	100				SILTY SAND SM
7			9	17	68	80	92	100	SILTY GRAVELLY SAND SM-GM
8			7	62	92	98	100		SAND SP-SM
9			7	39	87	96	100		SAND SP-SM
10			8	27	77	89	100		SAND SW-SM
11			22	73	93	97	100		SILTY SAND SM
12			10	26	58	87	96	100	SILTY GRAVELLY SAND SM-SW
13	30	6	41	88	99	100			CLAYEY SAND SC-SM
14	18	4	41	90	100				SILTY SAND SM
15			35	79	100				SILTY SAND SM
16			32	80	93	96	100		SILTY SAND SM-SW
17	28	12	33	66	83	93	98	100	CLAYEY GRAVELLY SAND SC
18			33	63	72	76	88	100	SILTY GRAVELLY SAND SM-SW
19	28	15	17	66	86	96	100		CLAYEY SAND SC
20			24	54	83	86	98	100	CLAYEY GRAVELLY SAND SC
21			13	58	66	75	90	100	SILTY GRAVELLY SAND SM
22			8	58	76	79	84	100	GRAVELLY SAND SW-SM
23			7	86	99	100			SAND SP-SM
24			35	99	100				SILTY SAND SM
25			18	53	68	83	91	100	SILTY GRAVELLY SAND SM
26			8	76	95	95	100		GRAVELLY SAND SW-SM
27			13	53	96	98	100		SILTY SAND SM
28			13	63	100				SILTY SAND SM

GENERAL NOTES:

1. All Elevations shown refer to Feet above M.S.L., 1954 General Adjustment.
2. For Boring Legend, Classification of Soils and Descriptive Notes, see PLATE A6.
3. For Location of Borings, see PLATE A4.
4. Estimated Elevations shown on Drill Holes are generally 5 Feet higher than the actual Elevation of the top of ground.

NOTES:

1. The number in the Logs refer to the sample numbers of coarse grained material tested and presented in this tabulation.
2. The Laboratory Classification of the Clay Soils above the pervious stratum was primarily Lean Clay with some Fat Clay.



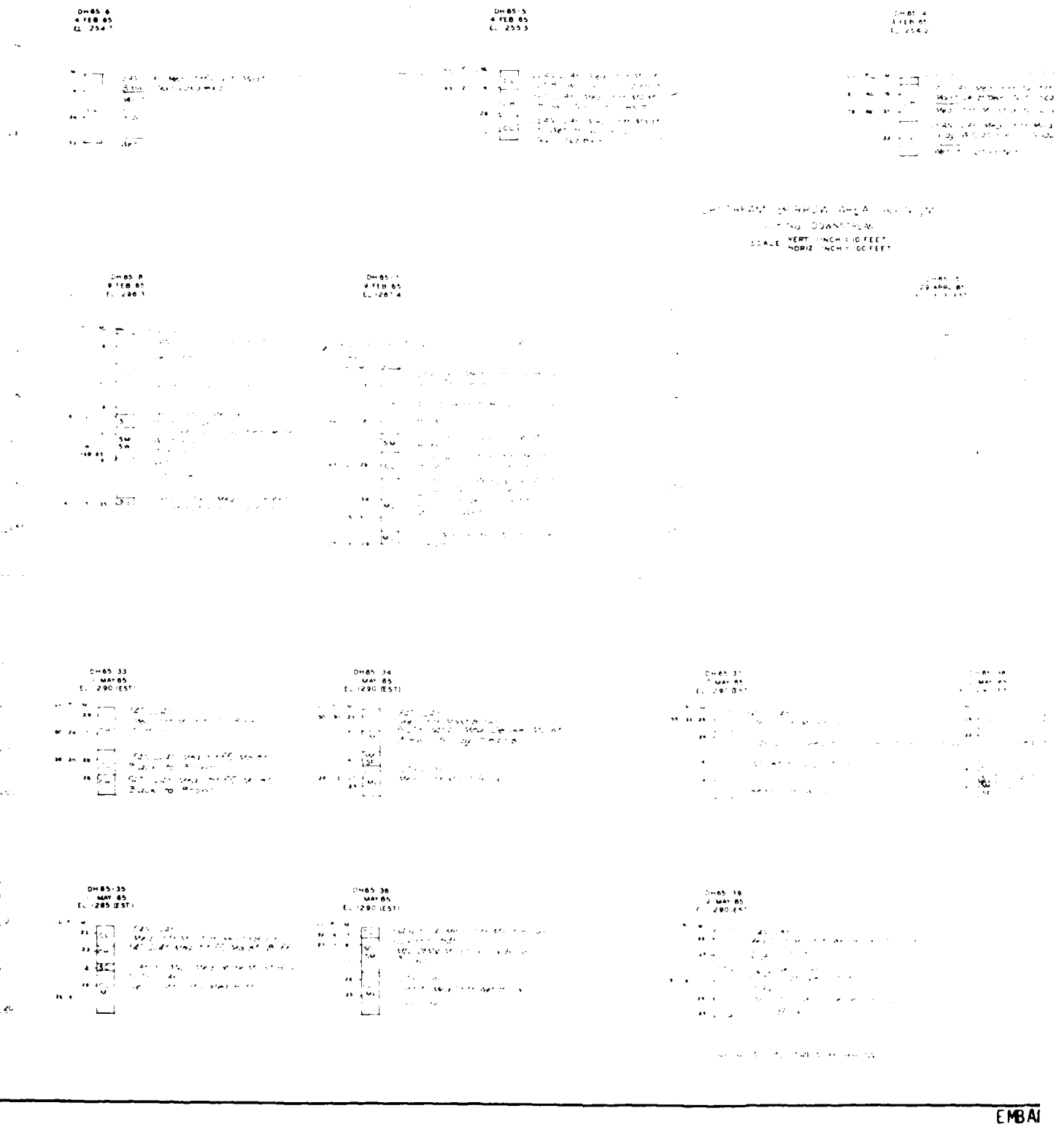
SCALE: VERT 1 INCH = 10 FEET
HORZ 1 INCH = 50 FEET

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

BRANCHED OAK DAM AND LAKE
SITE NO 18
RECORD OF BORINGS
LEFT ABUTMENT AREA
SECTIONS L-L AND M-M

MSC13-310E33

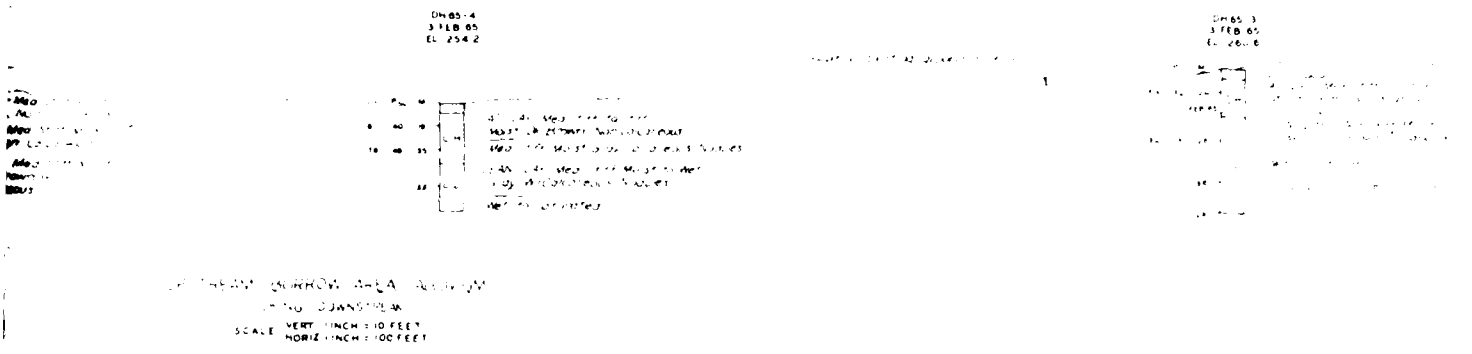
CORPS OF ENGINEERS

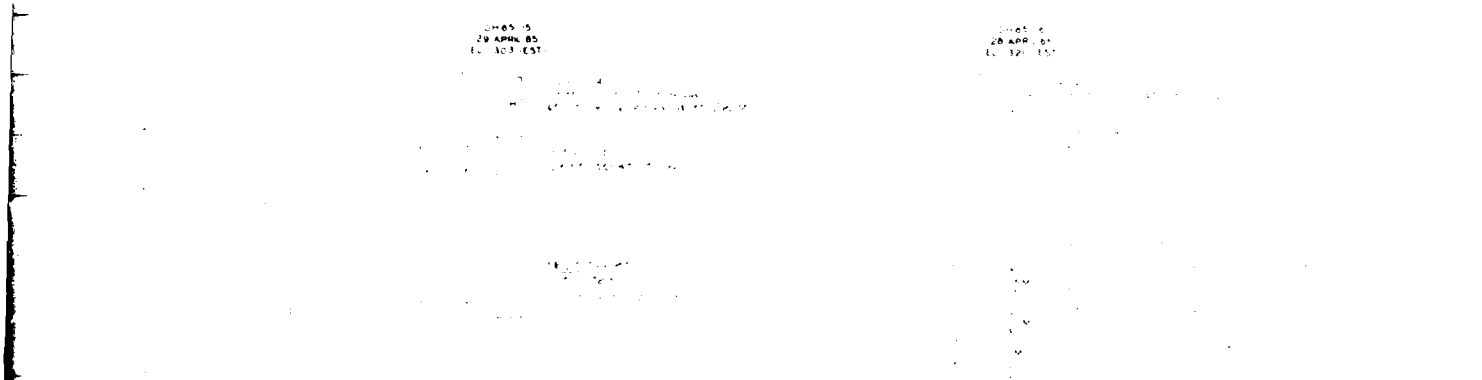


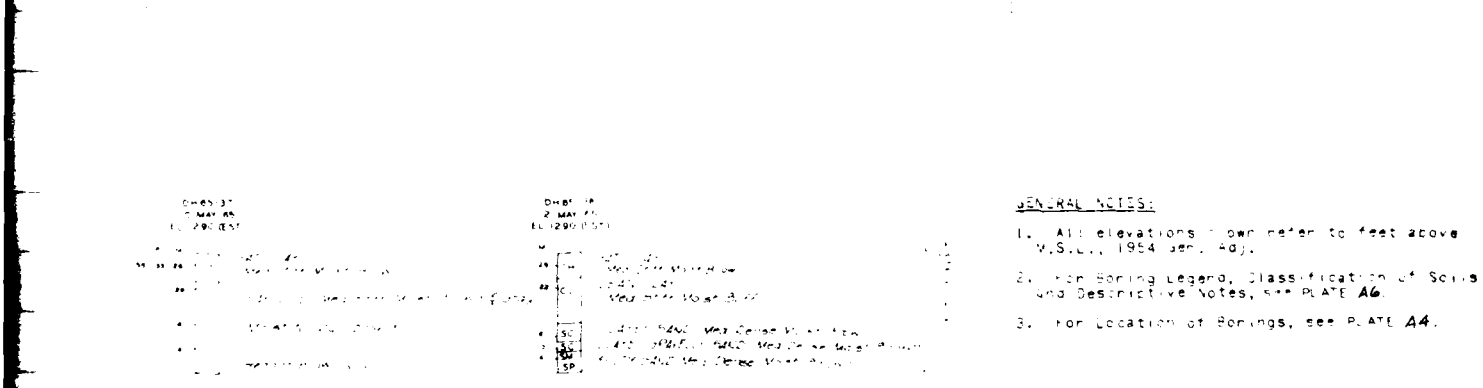
A 105 Micro-master Film or a Paper Reproducible Record Copy Must Be Made Before Every Amendment and/or Modification

AMENDMENT	
DATE	
MODIFICATION	
DATE	

EMBAI







GENERAL NOTES:

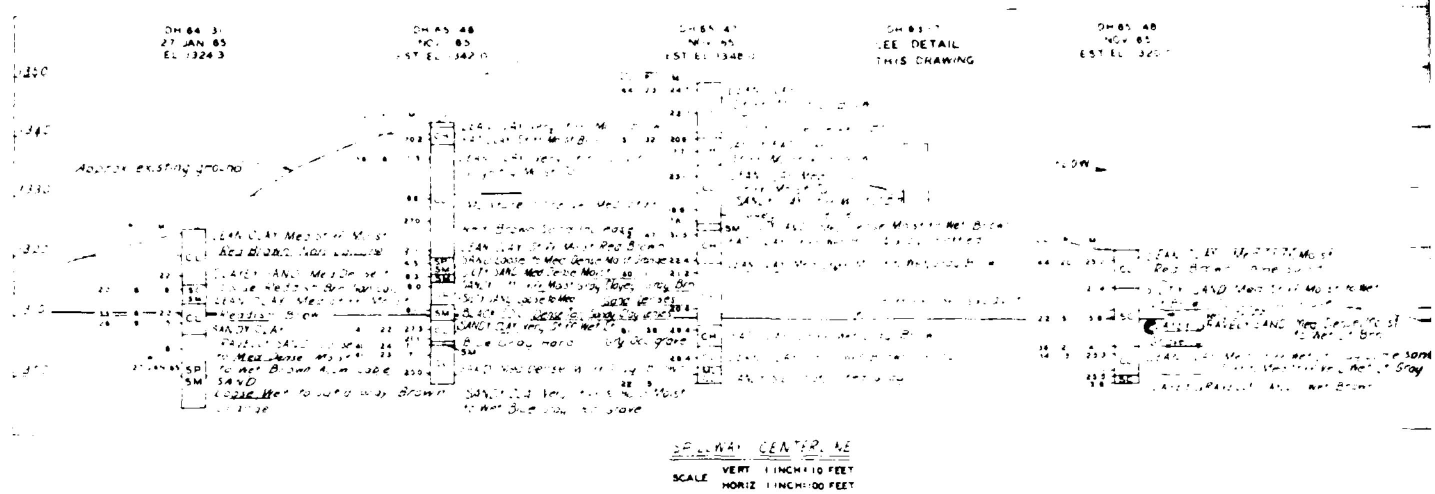
1. All elevations shown refer to feet above M.S.L., 1954 gen. Adj.
2. For Boring Legend, Classification of Soils and Descriptive Notes, see PLATE A6.
3. For Location of Borings, see PLATE A4.

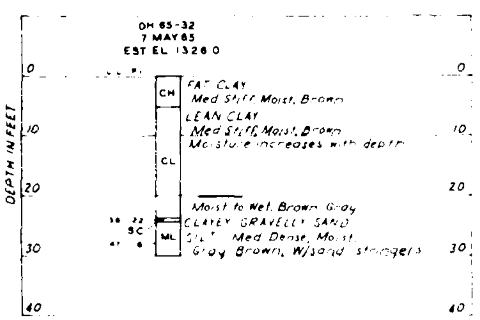
U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

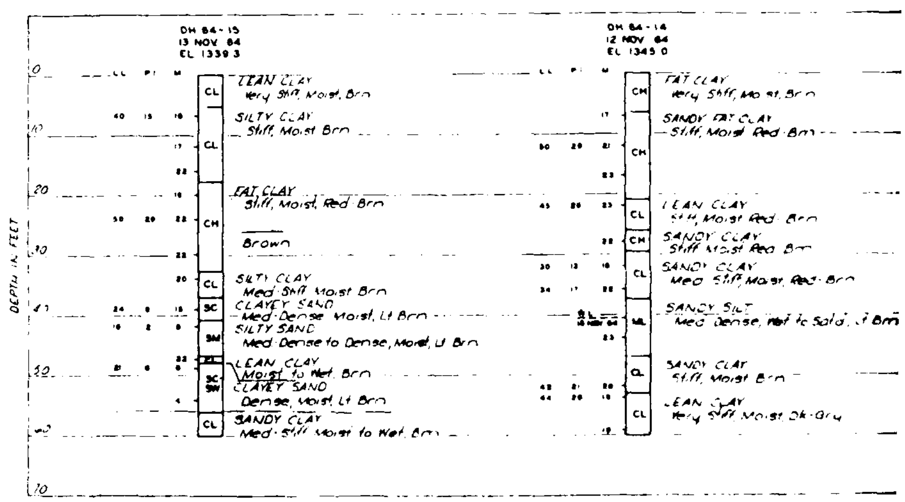
BRANCHED OAK DAM AND LAKE
SITE NO 18
RECORD OF BORINGS
UPSTREAM BORROW AREAS

MSC13-310E 34

CORPS OF ENGINEERS



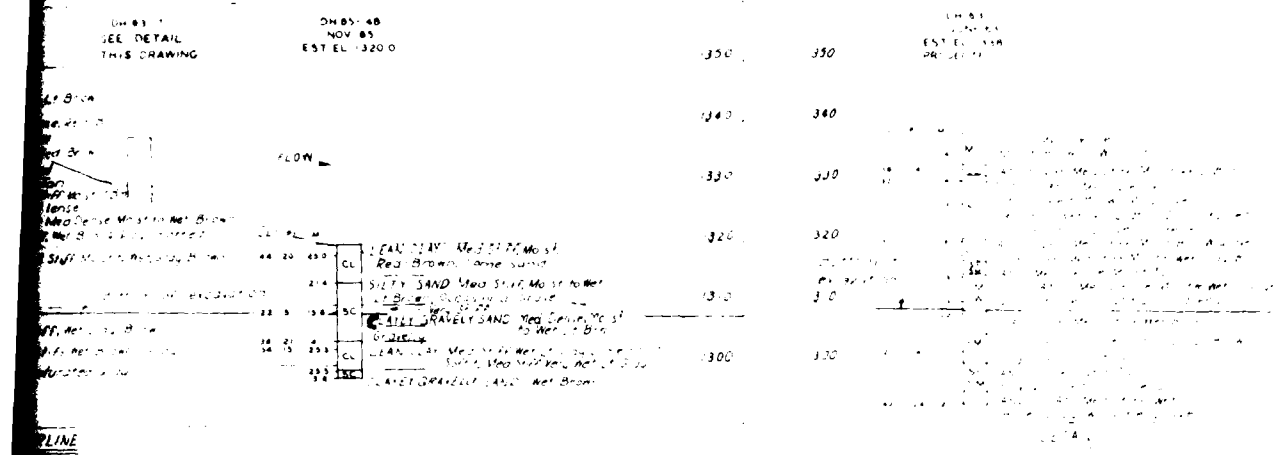


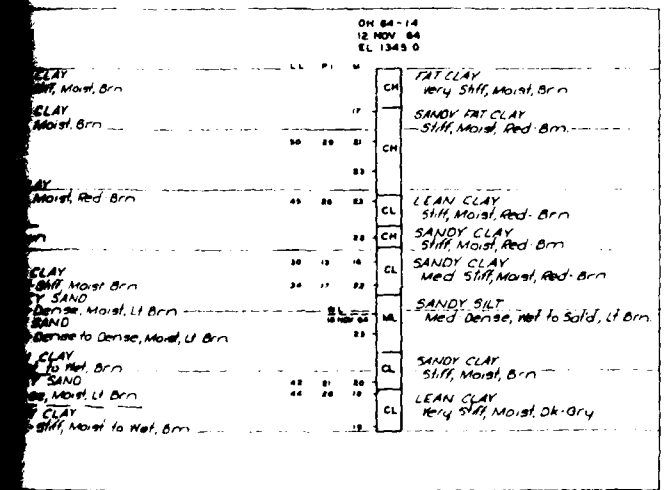


A 105 Micro-master Film or a Paper Reproducible Record Copy Must Be Made Before Every Amendment and/or Modification

AMENDMENT | DATE | MODIFICATION | DATE

EMBANK





GENERAL NOTES:

1. All elevations shown refer to feet above M.S.L., 1954 Gen. Adj.
2. For Boring Legend, Classification of Soils and Descriptive Notes, see PLATE A6.
3. For location of Borings, see PLATE A4.

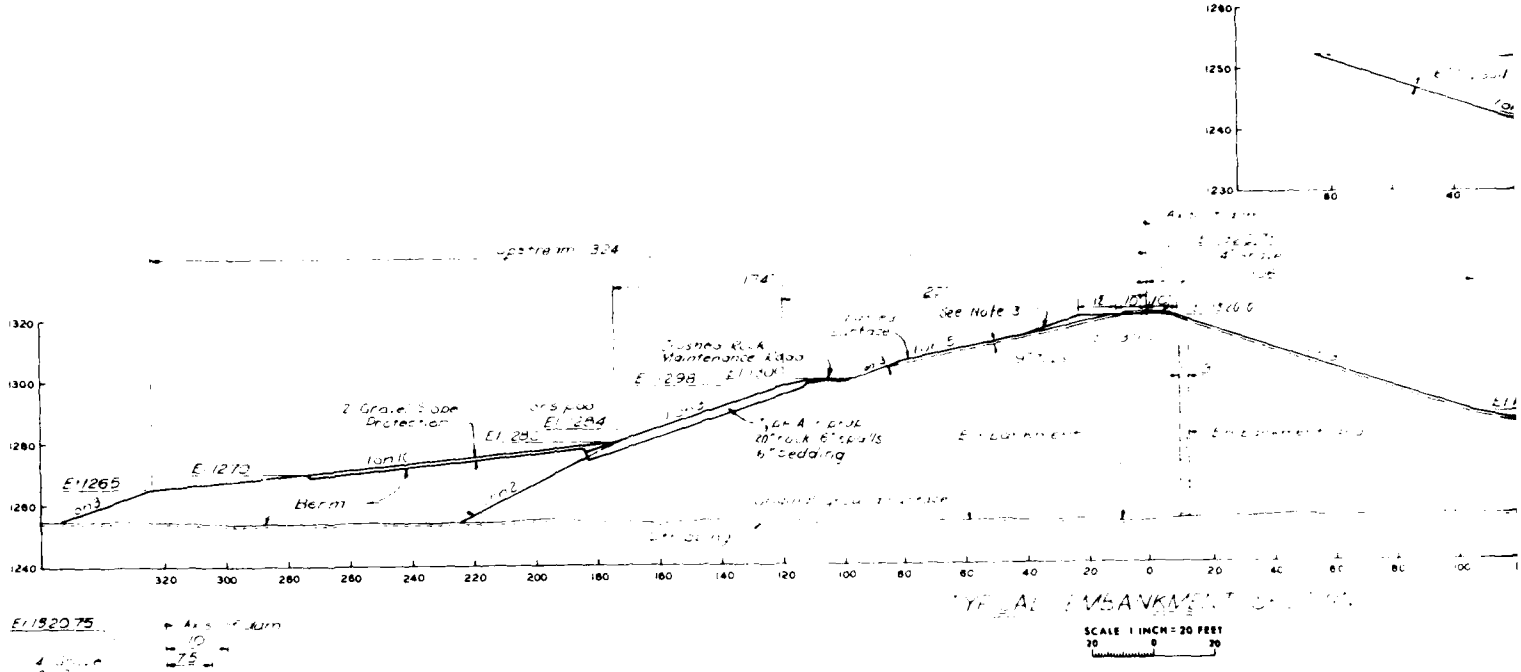
U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

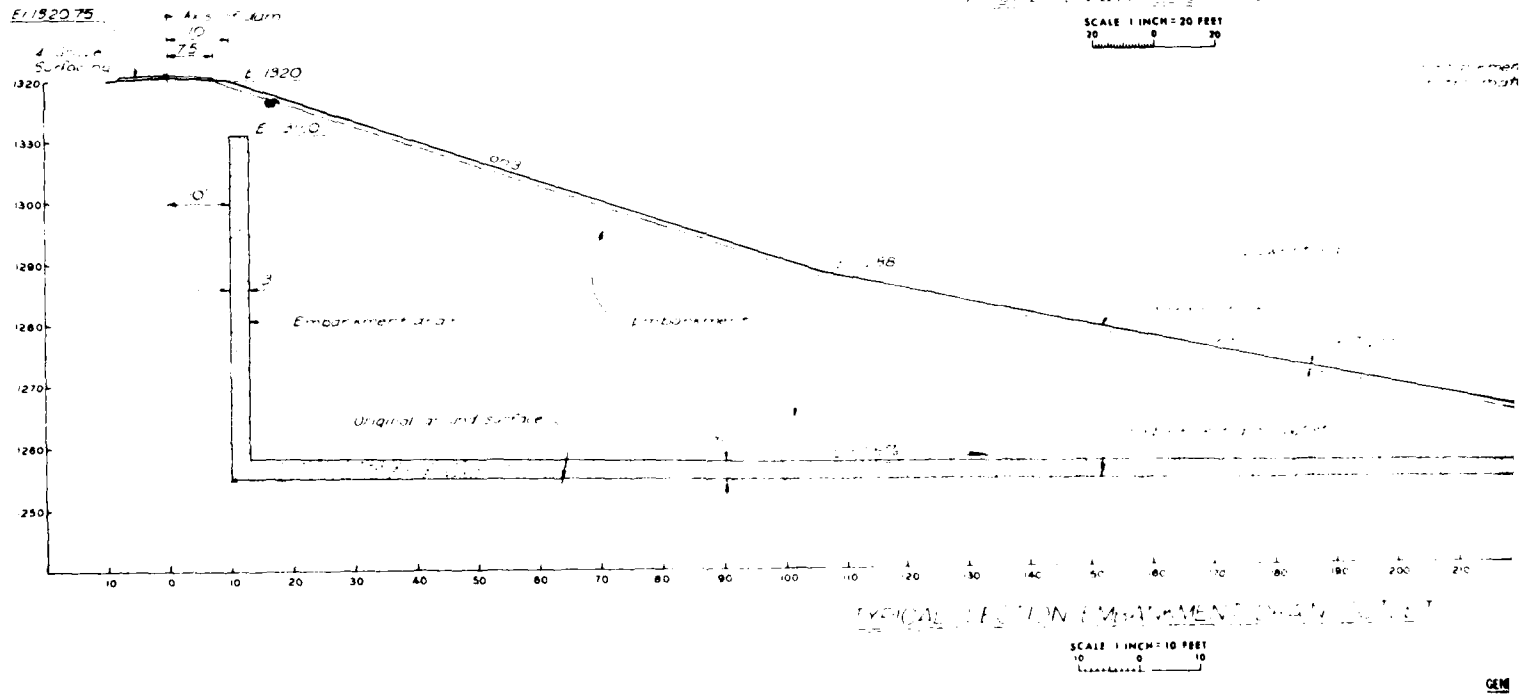
BRANCHED OAK DAM AND LAKE
SITE NO 18
RECORD OF BORINGS
SPILLWAY AREA

SCALE AS SHOWN

MSC13-310E35

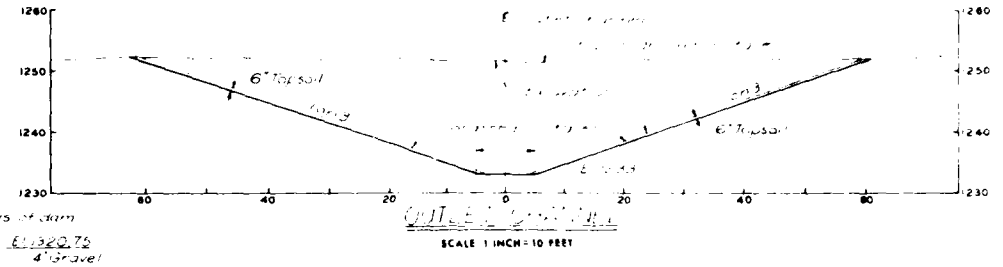
CORPS OF ENGINEERS





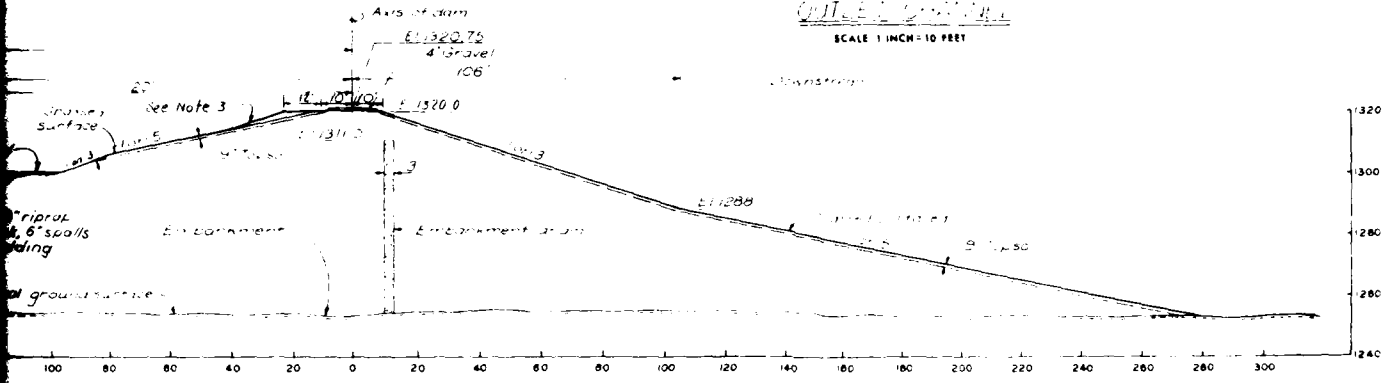
GEN
1.
M.
2.
"B"
3.
a

EMBANK



OUTLET CHANNEL

SCALE 1 INCH = 10 FEET

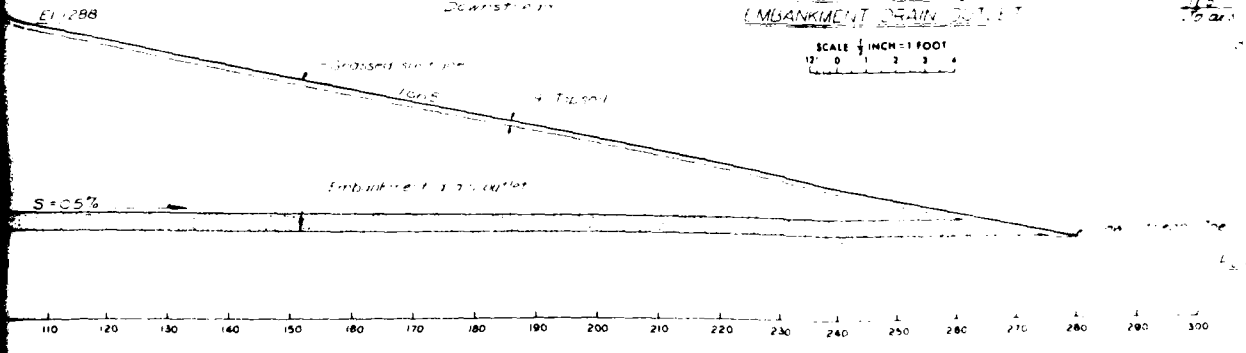


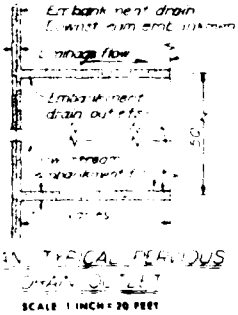
TYPICAL EMBANKMENT SECTION

SCALE 1 INCH = 20 FEET

TYPICAL SECTION
EMBANKMENT DRAIN OUTLET

SCALE ½ INCH = 1 FOOT





TYPICAL SECTION EMBANKMENT DRAIN OUTLET

SCALE 1 INCH = 20 FEET

TYPICAL SECTION EMBANKMENT DRAIN OUTLET

SCALE 1 INCH = 10 FEET
10 0 10

GENERAL NOTES:

1. All elevations shown refer to feet above M. S. L., 1954 General Adjustment.
2. This plate supersedes Plate 5 Appendix "B" 1968 Inspection Report.
3. Crest width widened 12 feet in 1970.

SAFETY PAYS

THIS PLAN ACCOMPANIES CONTRACT NO
MODIFICATION NO

U. S. ARMY ENGINEER DISTRICT OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

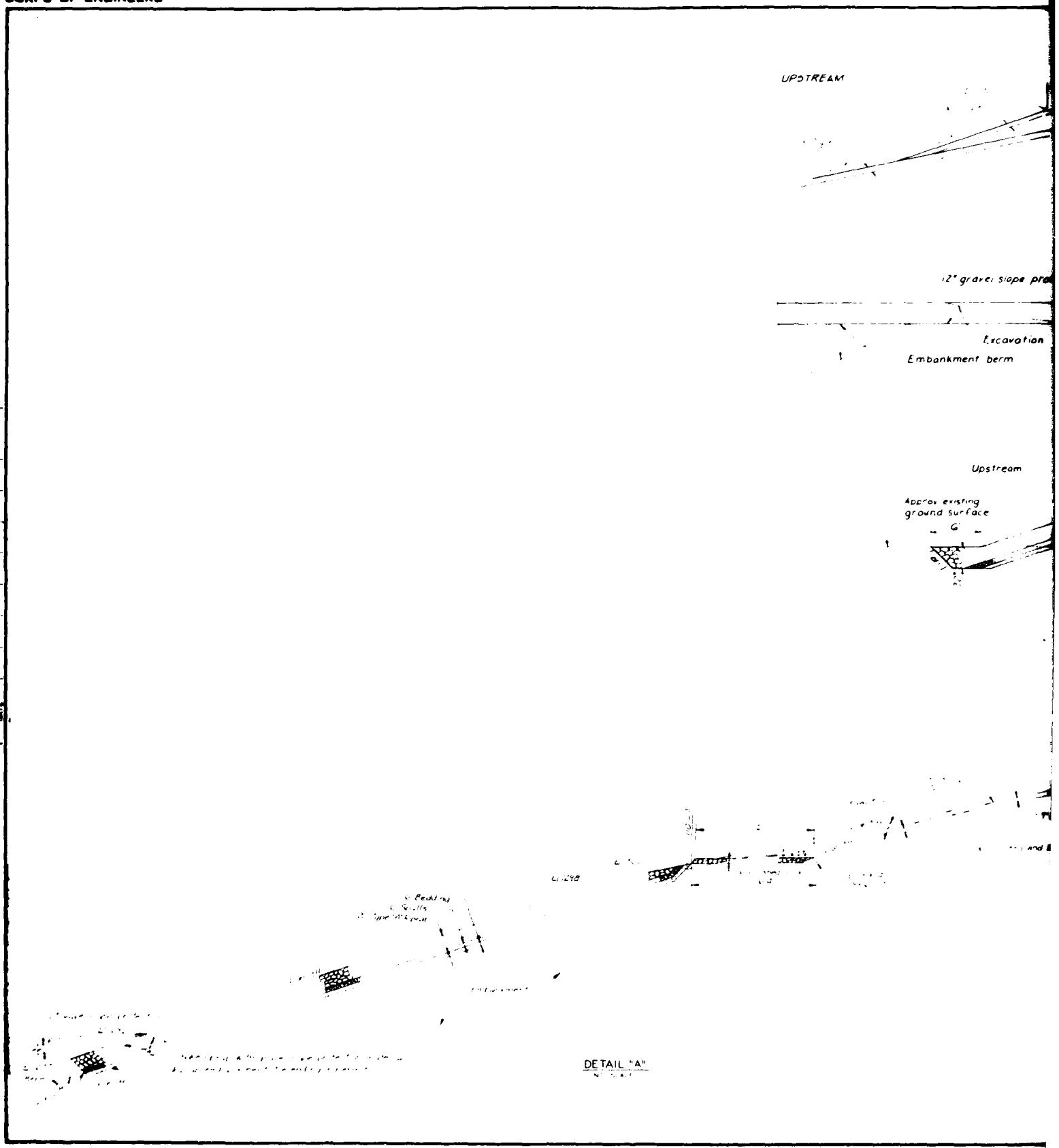
SALT CREEK AND ITS TRIBUTARIES, NEBRASKA

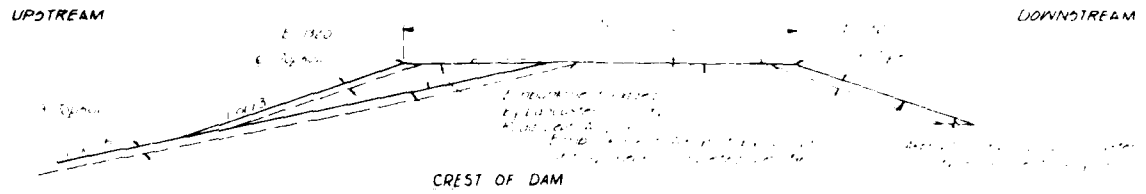
BRANCHED OAK DAM & RESERVOIR

TYPICAL SECTIONS,
EMBANKMENT, EMBANKMENT DRAIN
AND OUTLET CHANNEL

APPROVED Charles E. Popp

APPROVED F. P. Vandegrass

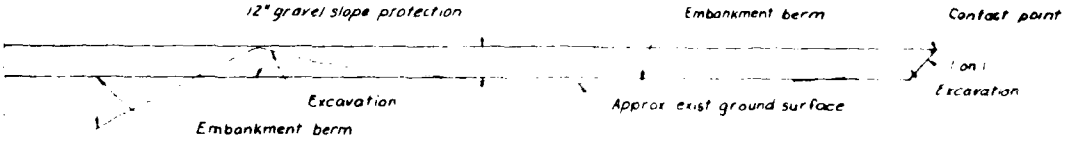

UPSTREAM
12" gravel slope pro
Excavation
Embankment berm
Upstream
Approx existing
ground surface
DETAIL "A"



CREST OF DAM

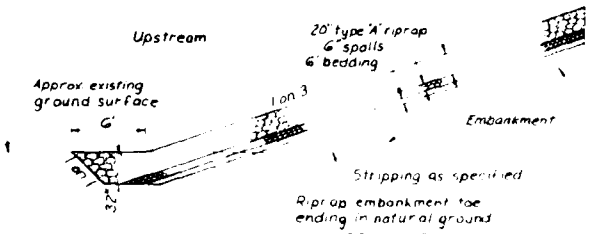
DETAIL "D"

SCALE 1 INCH = 5 FEET



DETAIL "E"

SCALE 1 INCH = 5 FEET

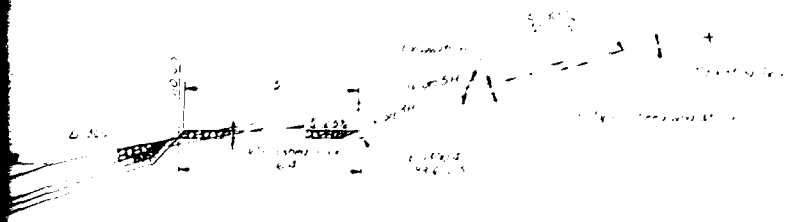


DETAIL "B"

NO SCALE

GENERAL NOTES:

1. All elevations shown refer to feet above M.S.L., 1954 General Adjustment.
2. For location of details, see PLATES A2 and A3.



DETAIL "A"

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA NEBRASKA

BRANCHED OAK DAM AND LAKE
SITE NO 18
EMBANKMENT
SECTIONS AND DETAILS

FEB 1966

MSCI3-21016

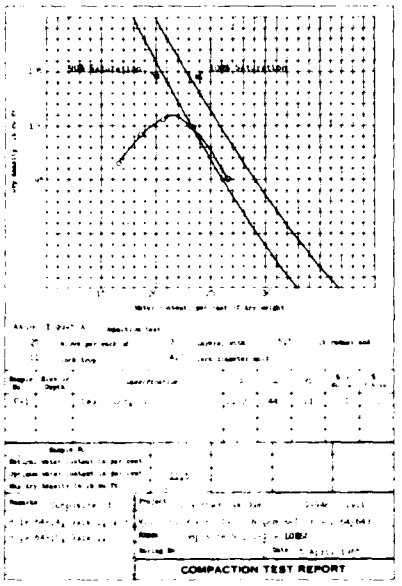


FIGURE 1

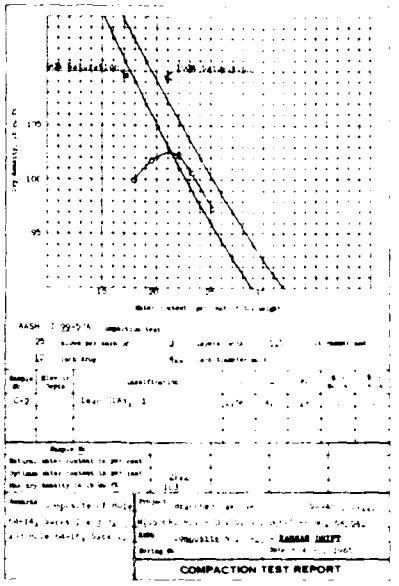


FIGURE 2

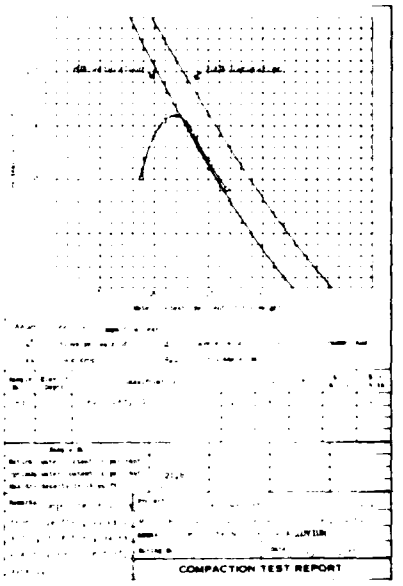
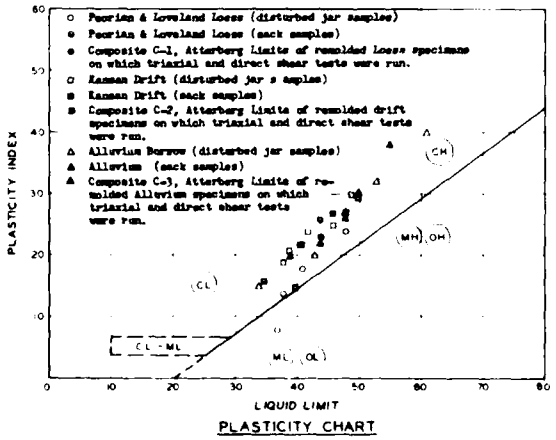
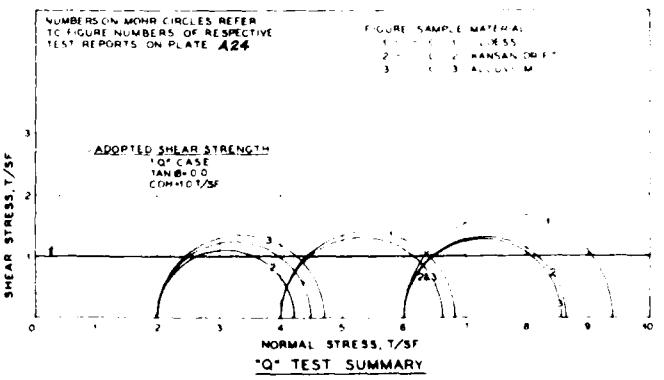


FIGURE 3



PLASTICITY CHART

FIGURE 5



"Q" TEST SUMMARY

FIGURE 6

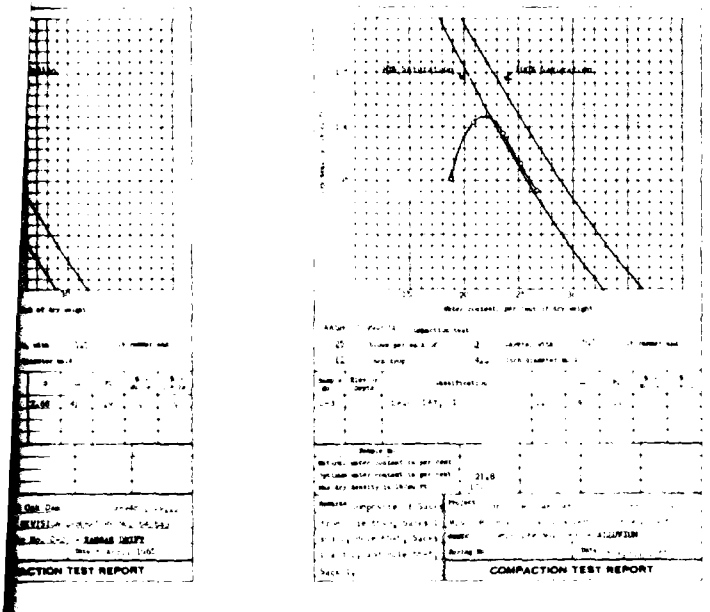


FIGURE 3

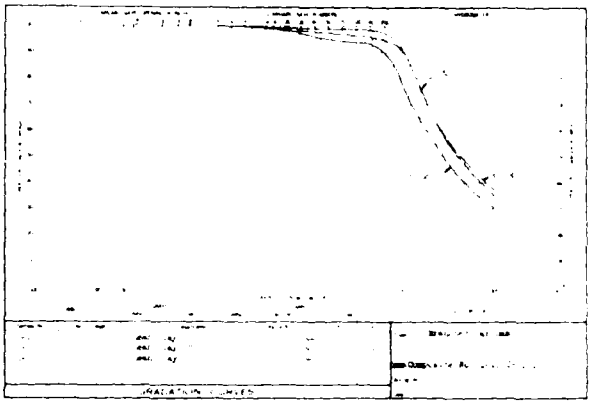
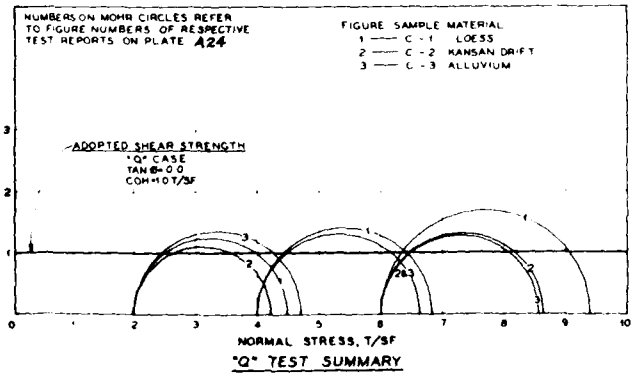
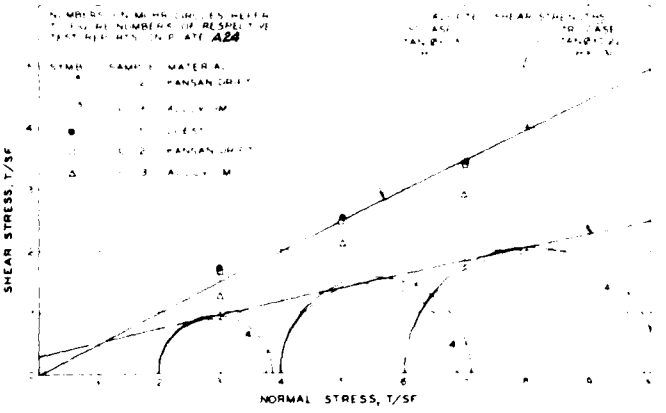


FIGURE 4



"Q" TEST SUMMARY

FIGURE 6



"R" & "S" TEST SUMMARY

FIGURE 7

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

SALT CREEK AND ITS TRIBUTARIES, NEBRASKA
BRANCHED OAK DAM & RESERVOIR
LABORATORY TEST DATA
REMOLDED EMBANKMENT MATERIAL
COMPACTION TESTS, TRIAXIAL AND
DIRECT SHEAR TEST SUMMARIES

SAFETY PAYS

THIS PLAN ACCOMPANIES CONTRACT NO
DA-25-066-
MODIFICATION NO

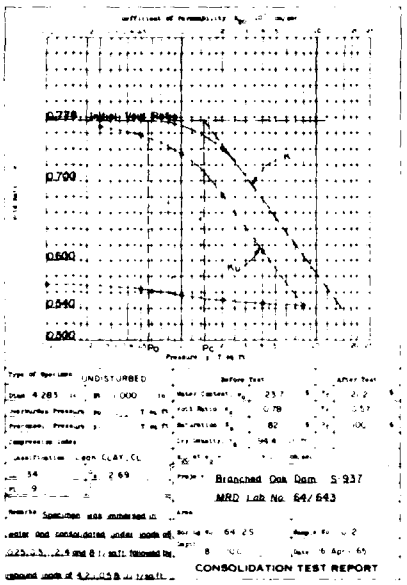


FIGURE 1

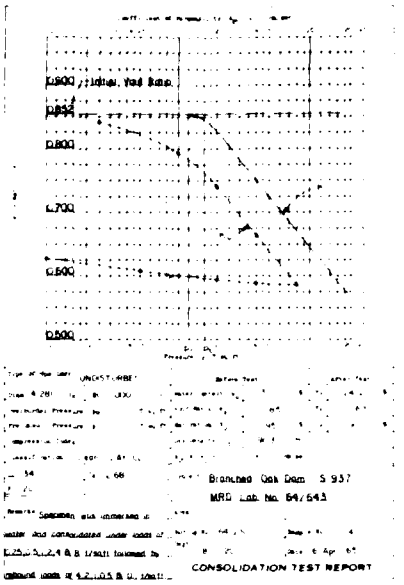


FIGURE 2

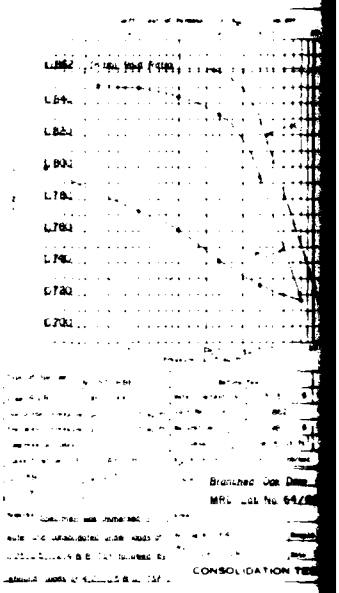


FIGURE 3

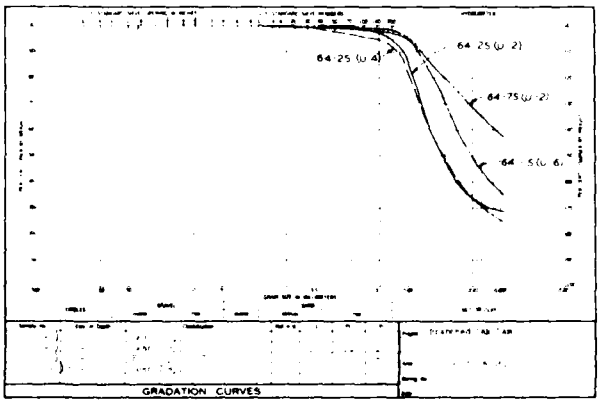


FIGURE 5

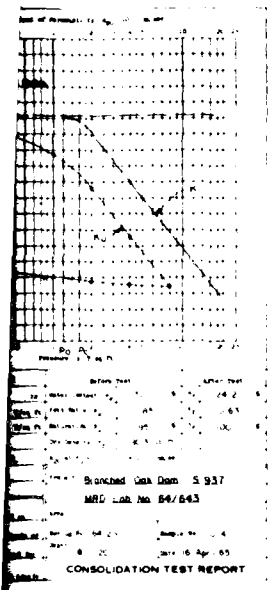


FIGURE 2

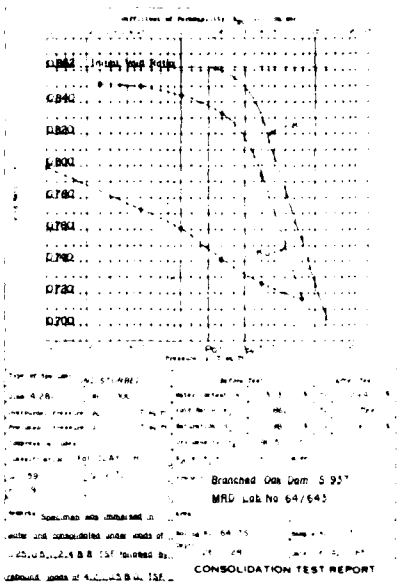


FIGURE 3

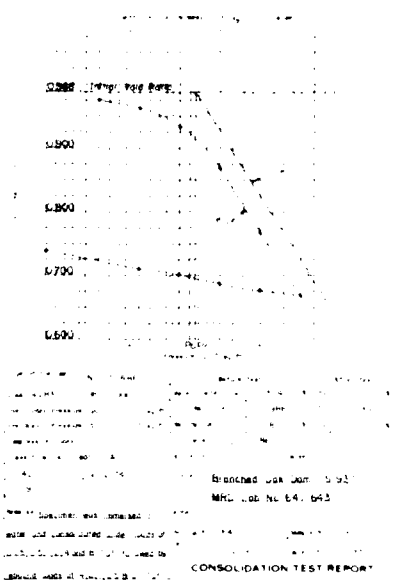


FIGURE 4

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

SALT CREEK AND ITS TRIBUTARIES, NEBRASKA

BRANCHED OAK DAM & RESERVOIR

LABORATORY TEST DATA

CONSOLIDATION TESTS
FLOOD PLAIN ALLUVIUM

SAFETY PAYS

THIS PLAN ACCOMPANIES CONTRACT No DA-25-066-
MODIFICATION No

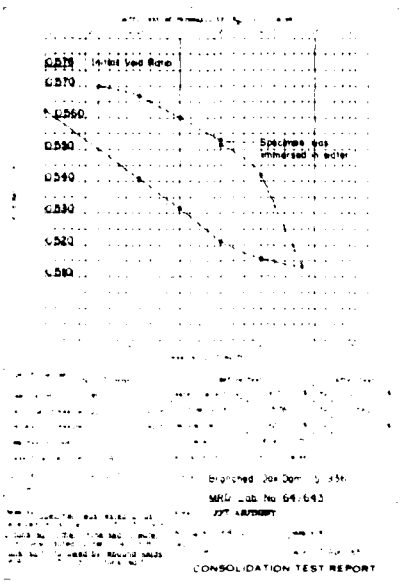


FIGURE 1

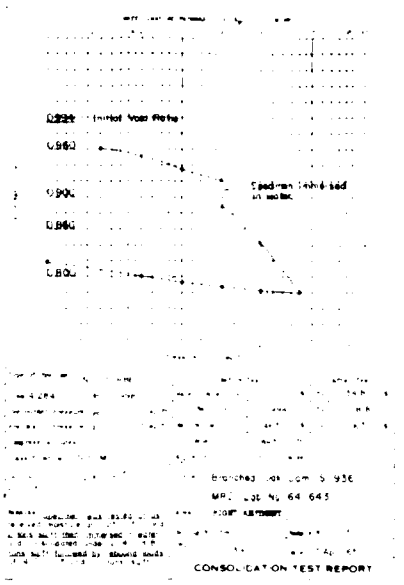


FIGURE 2

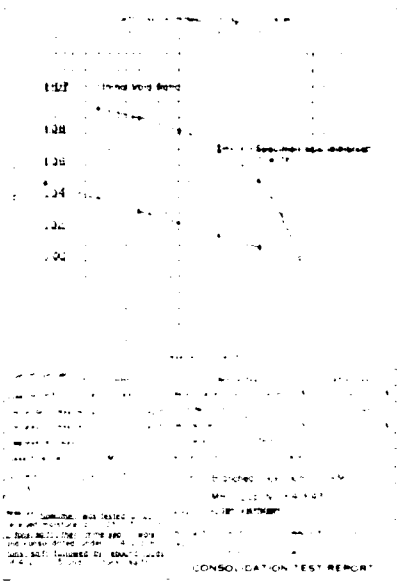


FIGURE 3

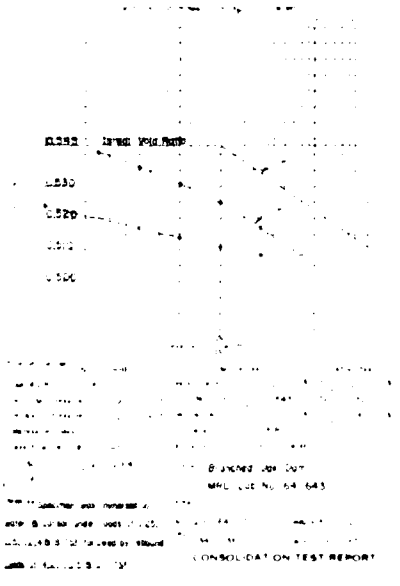


FIGURE 5

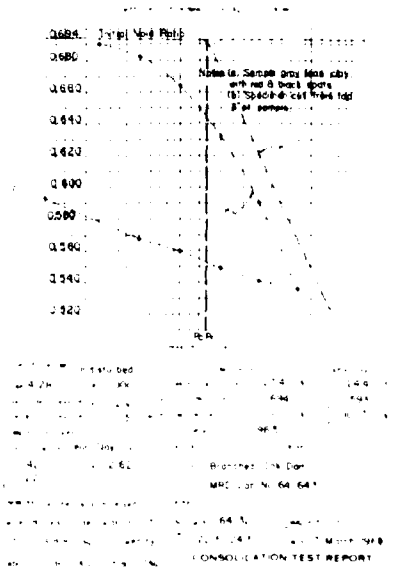


FIGURE 6

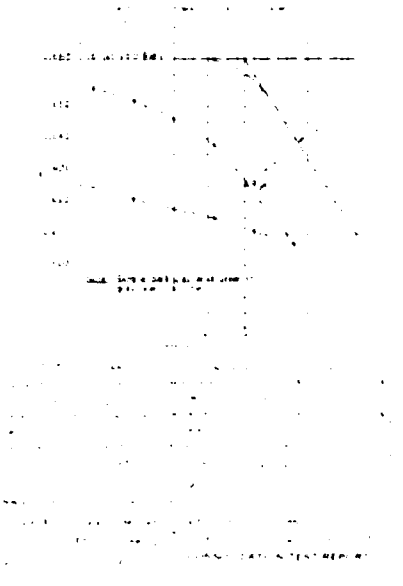
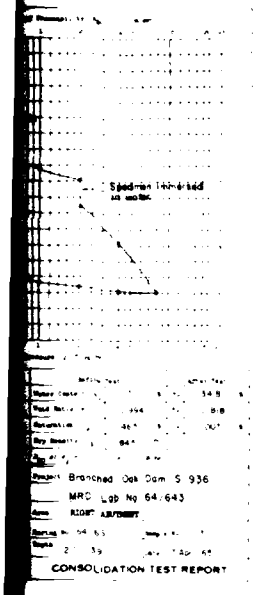


FIG. 8

EMBANKM



IGURE 2

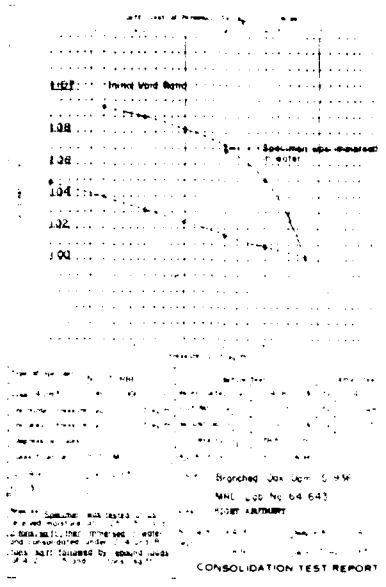
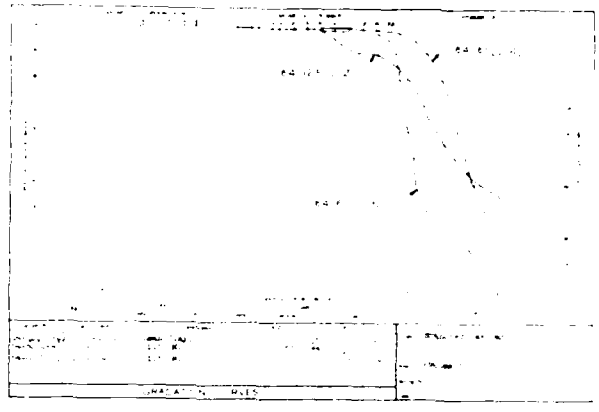


FIGURE 3



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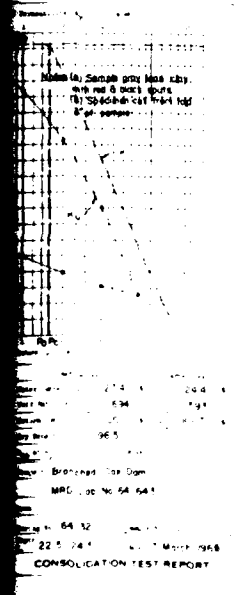


GURE 6

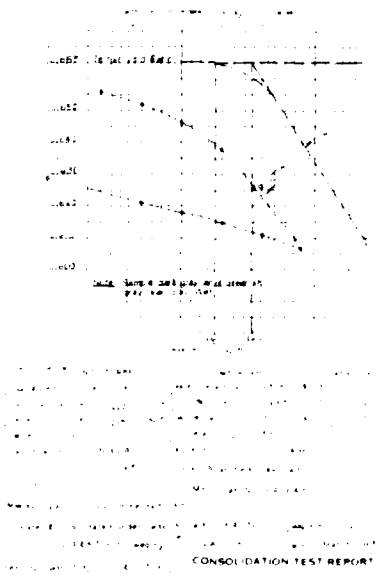


FIGURE 7

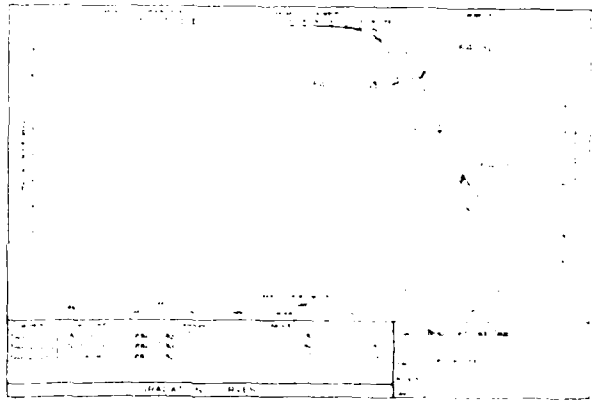


FIGURE 8

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

SALT CREEK AND TRIBUTARIES, NEBRASKA

BRANCHED OAK DAM & RESERVOIR

LABORATORY TEST DATA

CONSOLIDATION TESTS

ABUTMENT AND [illegible] WORKS AREA

THIS PLAN ACCOMPANIES CONTRACT NO. DA 25 066 [illegible] MODIFICATION NO.

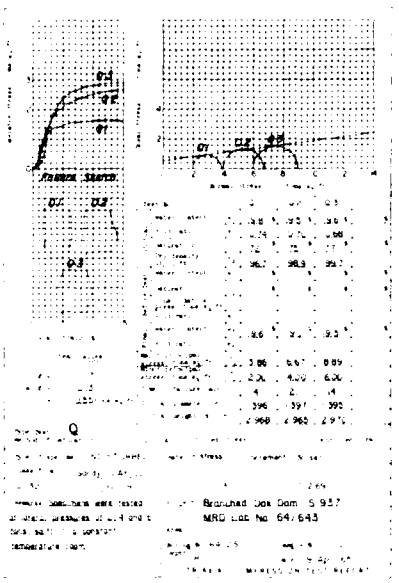


FIGURE 1

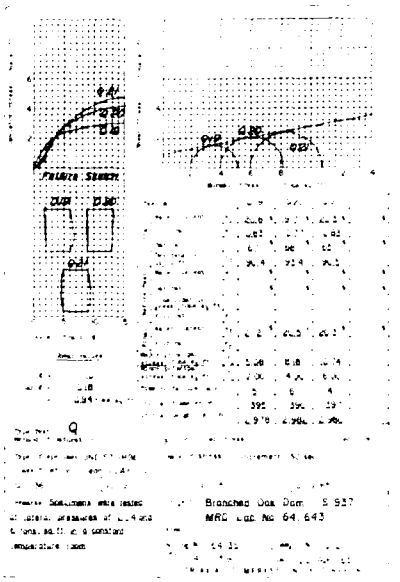
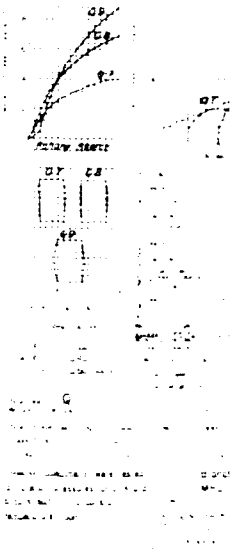


FIGURE 2



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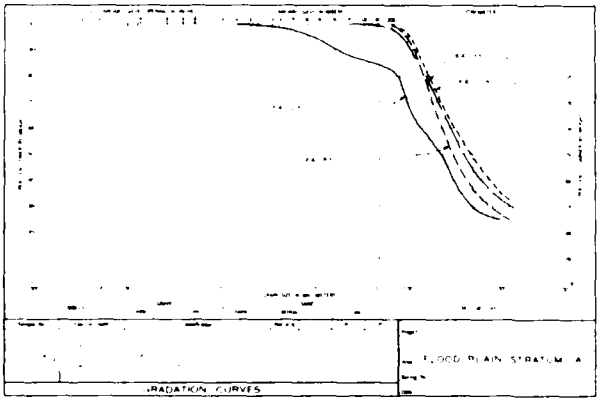
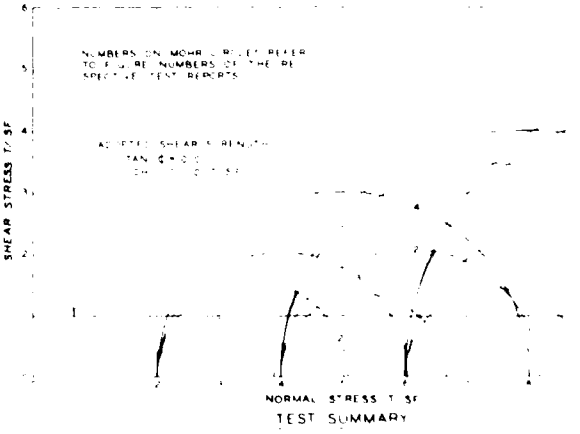


FIGURE 5



TEST SUMMARY

FIGURE 6

EMB

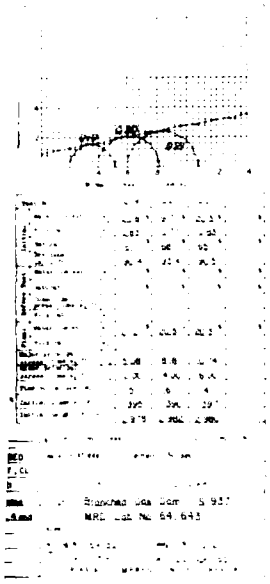


FIGURE 2

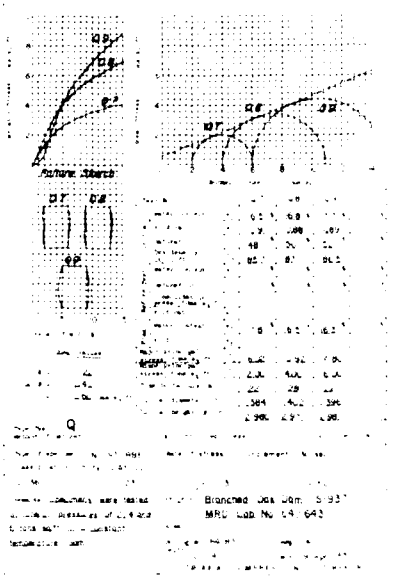


FIGURE 3

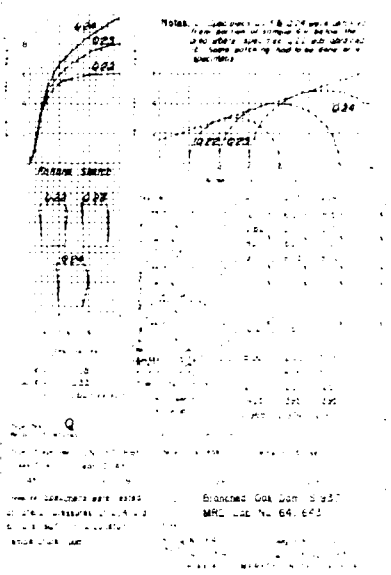
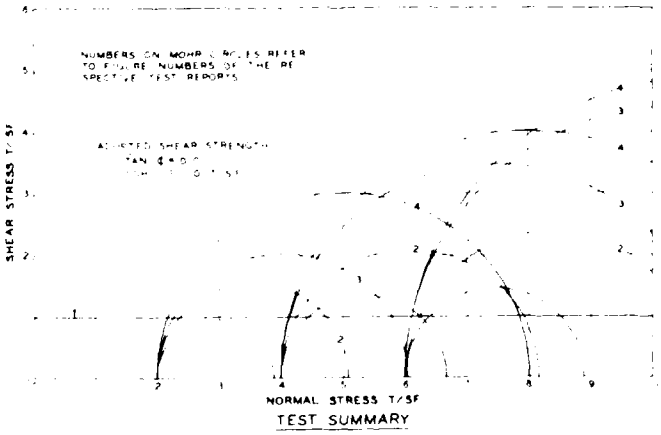


FIGURE 4



TEST SUMMARY

FIGURE 6

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

SALT CREEK AND ITS TRIBUTARIES, NEBRASKA
BRANCHED OAK DAM & RESERVOIR
LABORATORY TEST DATA
UNCONSOLIDATED-UNDRAINED "Q" TESTS
STRATUM "A"

THIS PLAN ACCOMPANIES CONTRACT NO DA-25-066-eng MODIFICATION NO

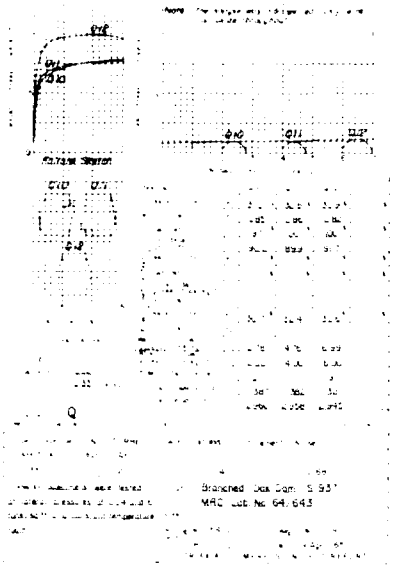
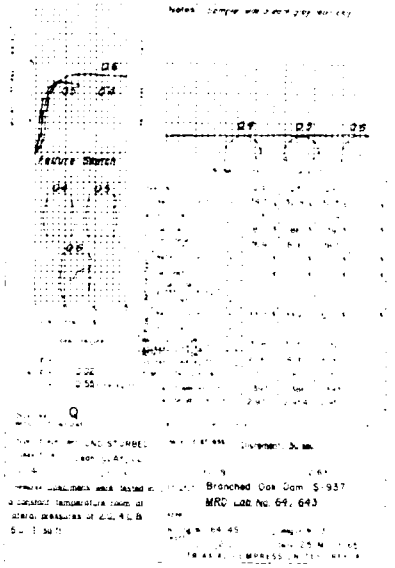


FIGURE 1



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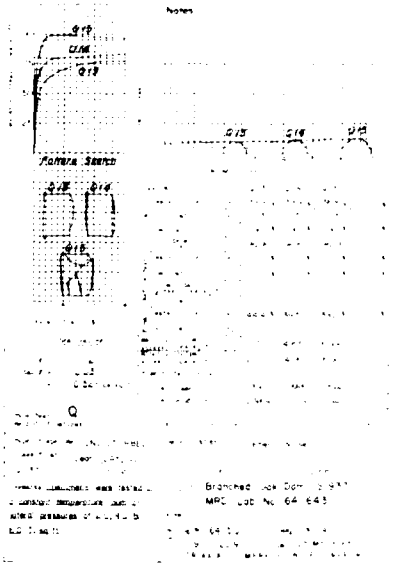

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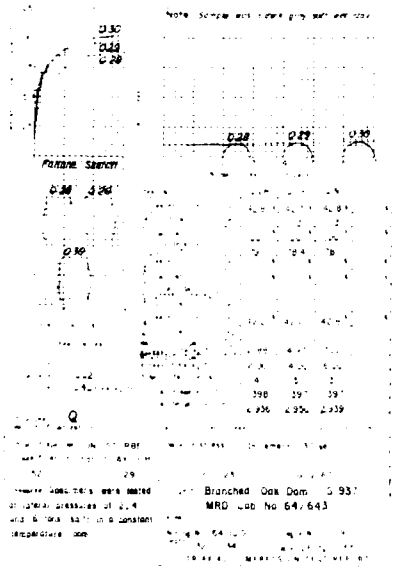


FIGURE 6

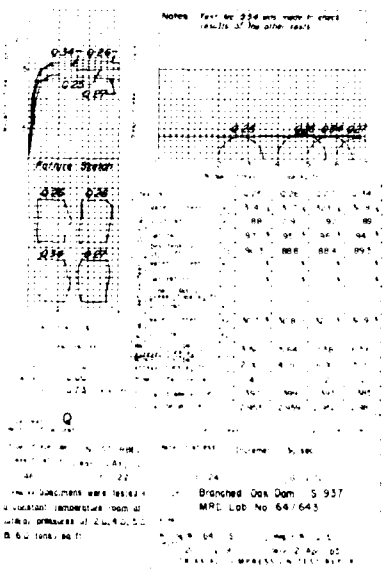


FIGURE 7

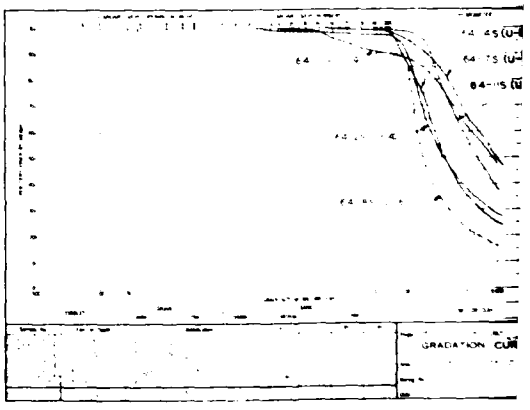
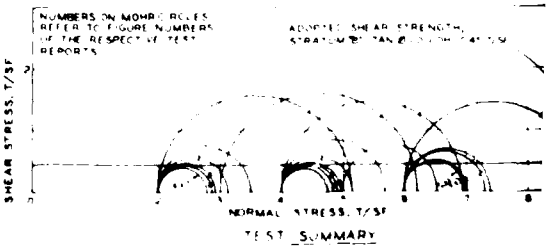


FIGURE 8



TEST SUMMARY

FIGURE 10

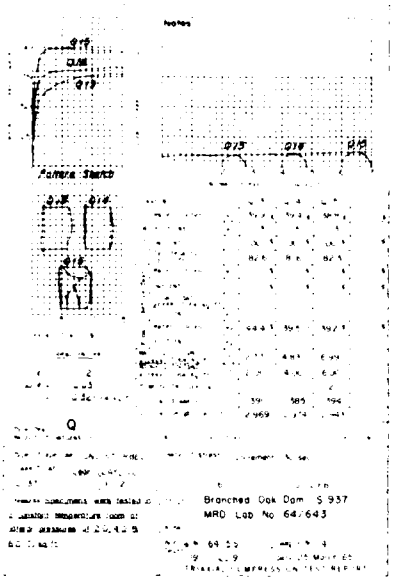


FIGURE 3

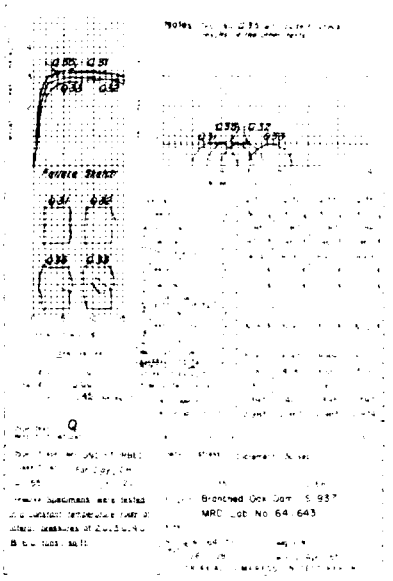


FIGURE 4

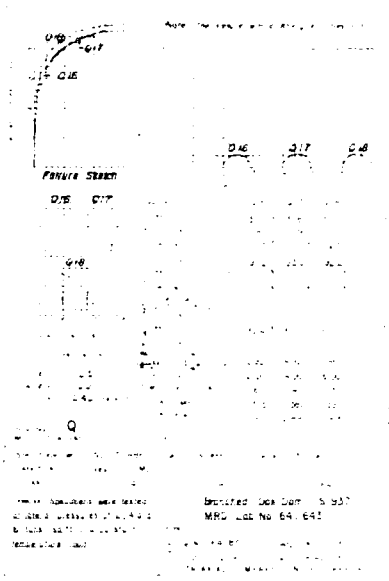


FIGURE 5

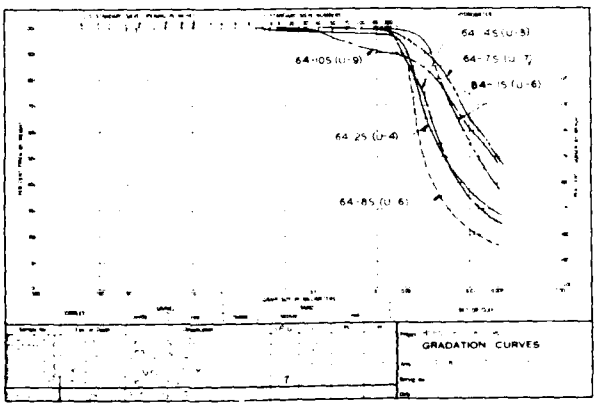
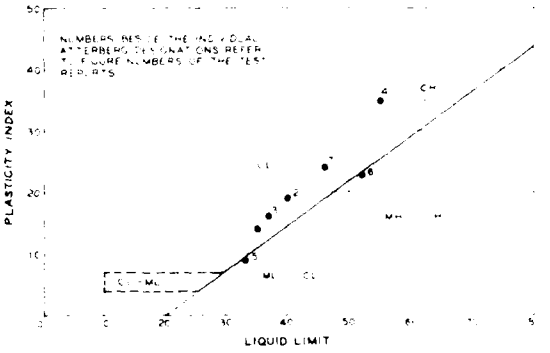
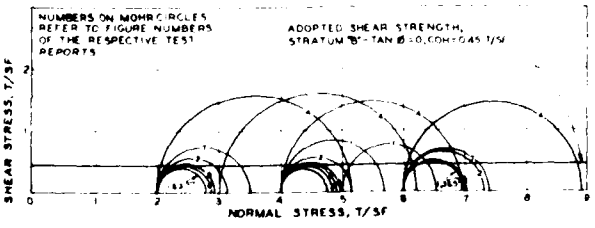


FIGURE 8



PLASTICITY CHART

FIGURE 9



TEST SUMMARY

FIGURE 10

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA NEBRASKA

SALT CREEK AND ITS TRIBUTARIES, NEBRASKA
BRANCHED OAK DAM & RESERVOIR
LABORATORY TEST DATA
UNCONSOLIDATED-UNDRAINED "Q" TESTS
STRATUM B

THIS PLAN ACCOMPANIES CONTRACT No DA-25-066-
MODIFICATION No

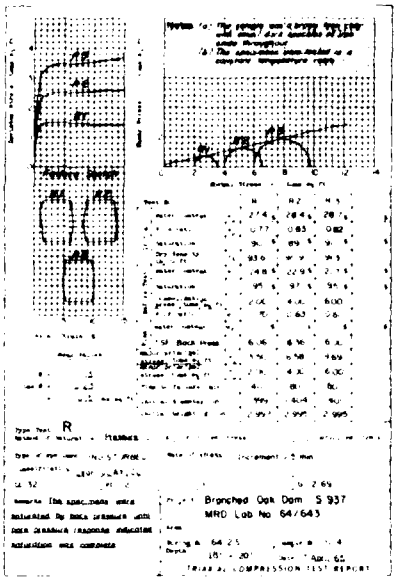


FIGURE 1

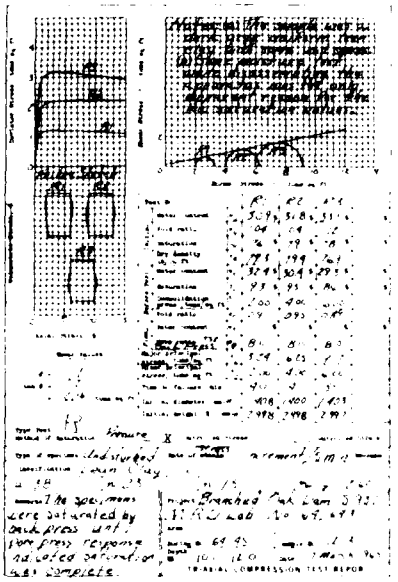


FIGURE 2

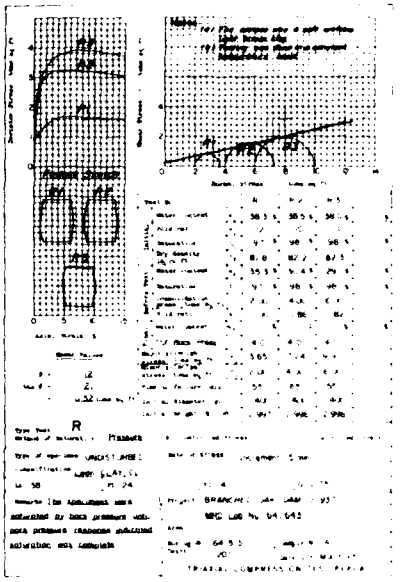


FIGURE 3

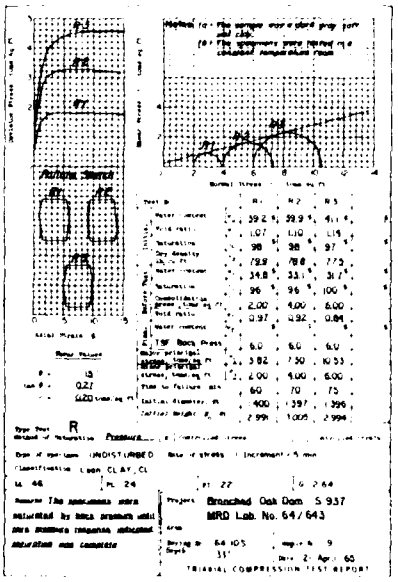


FIGURE 6

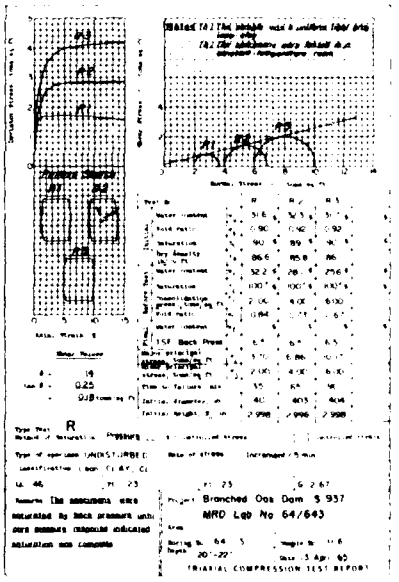


FIGURE 7

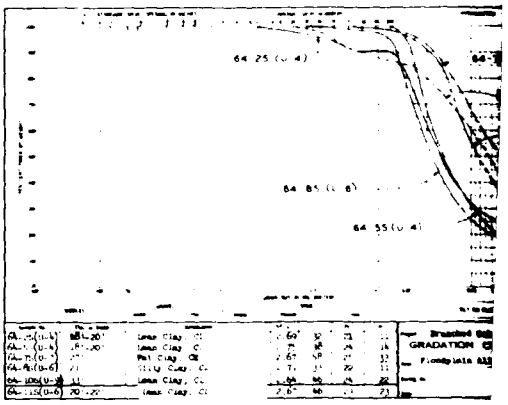


FIGURE 8

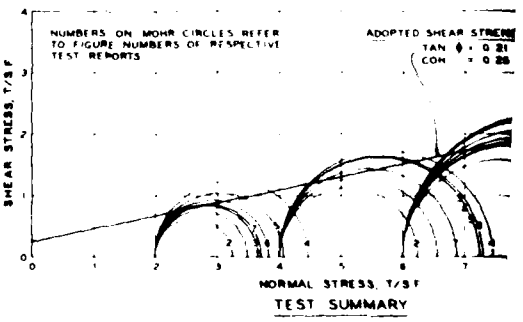


FIGURE 10

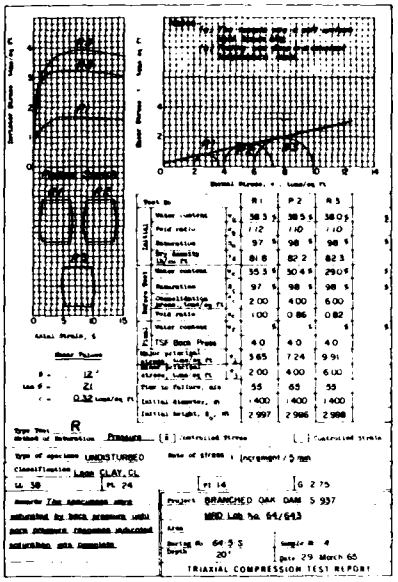


FIGURE 3

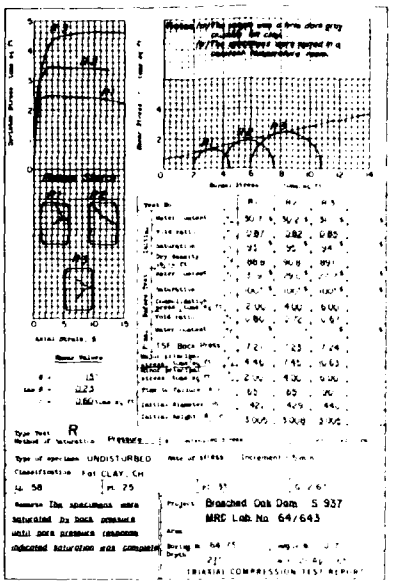


FIGURE 4

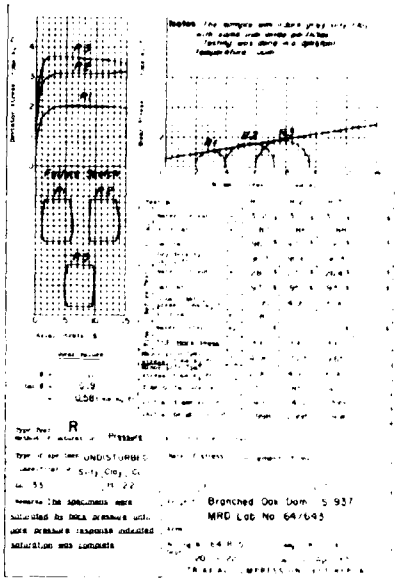


FIGURE 5

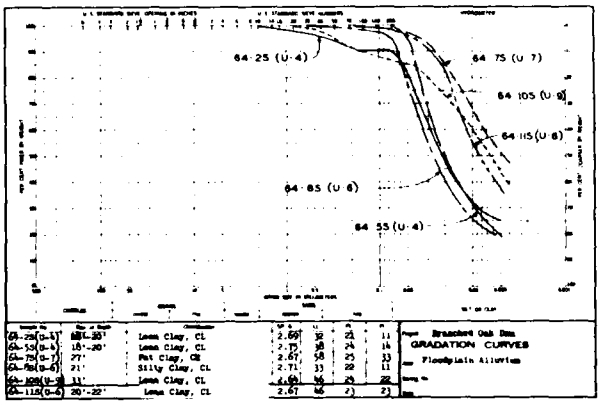
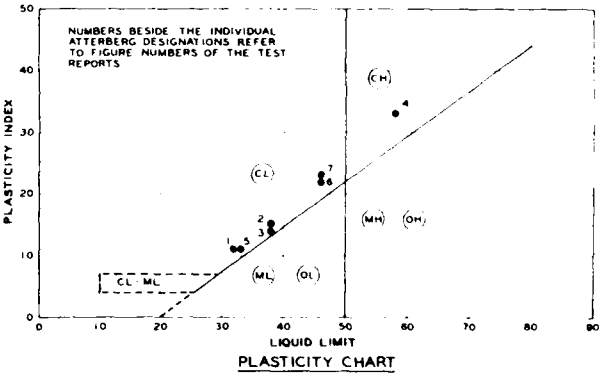
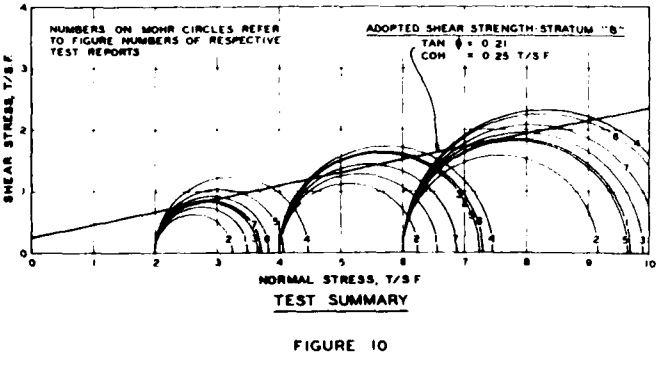


FIGURE 8



PLASTICITY CHART

FIGURE 9



TEST SUMMARY

FIGURE 10

THIS DRAWING HAS BEEN REDUCED TO THREE-EIGHTHS THE ORIGINAL SCALE

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

SALT CREEK AND ITS TRIBUTARIES, NEBRASKA

BRANCHED OAK DAM & RESERVOIR

LABORATORY TEST DATA

CONSOLIDATED - UNDRAINED "R" TESTS

JUNE 1964

THIS PLAN ACCOMPANIES CONTRACT No. DA-25-066-eng- MODIFICATION No.

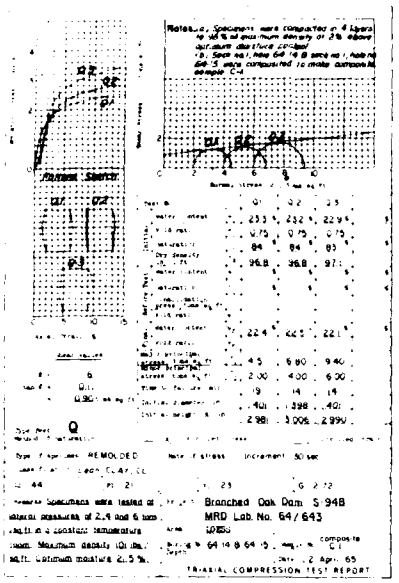


FIGURE 1

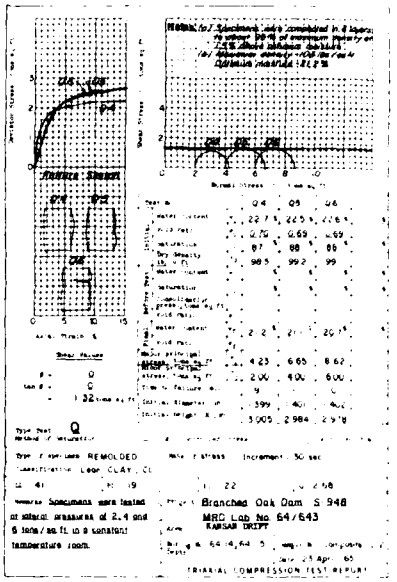


FIGURE 2

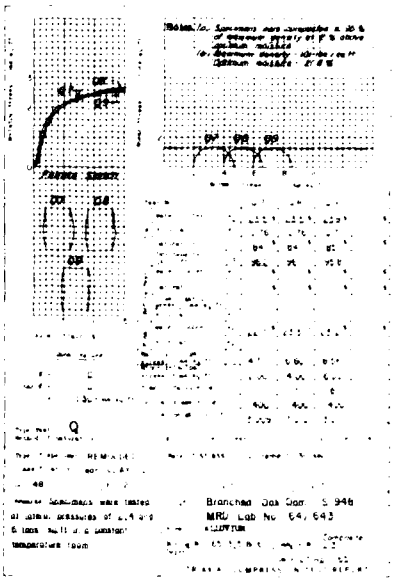


FIGURE 3

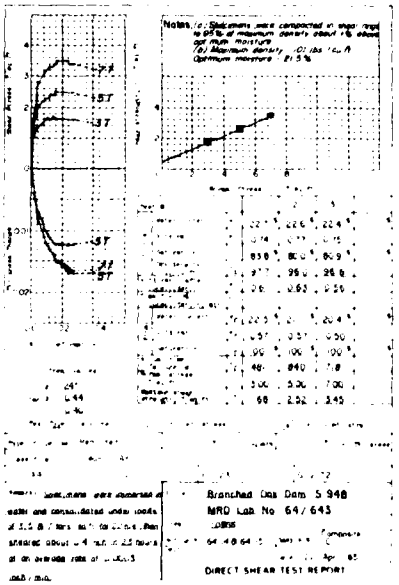


FIGURE 6

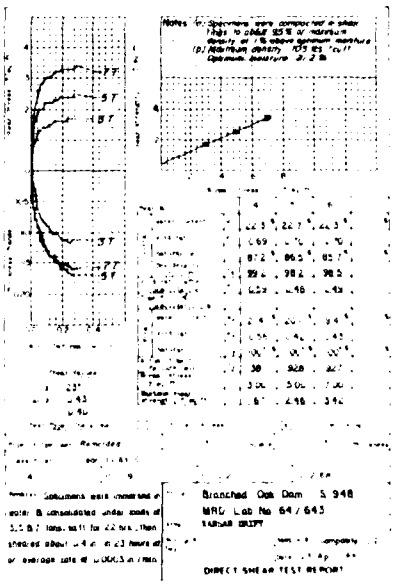


FIGURE 7

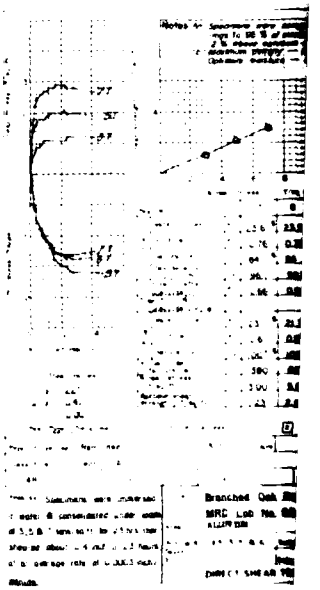


FIGURE 8

EMBAN

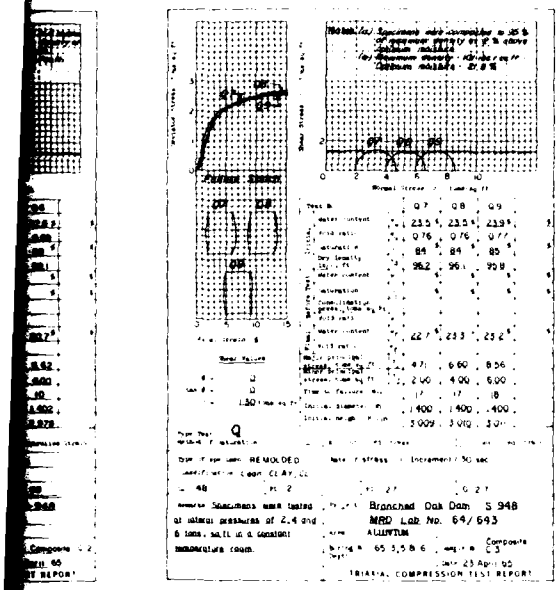


FIGURE 3

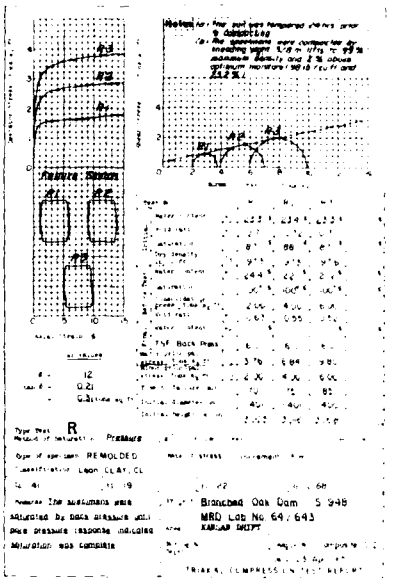


FIGURE 4

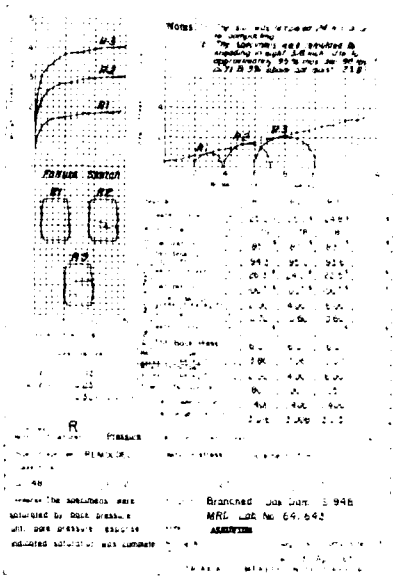


FIGURE 5

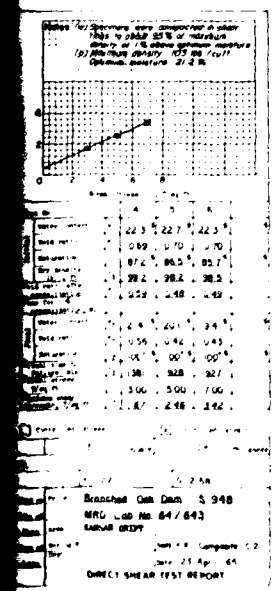


FIGURE 7

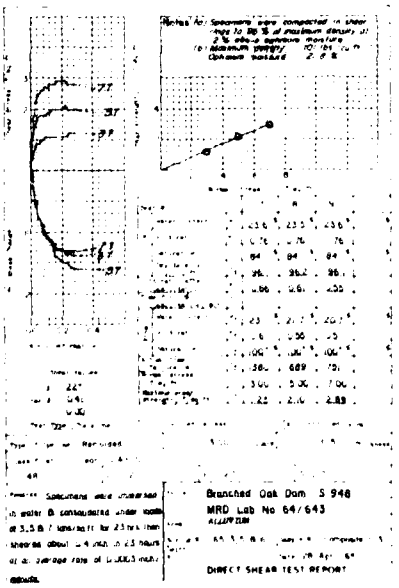
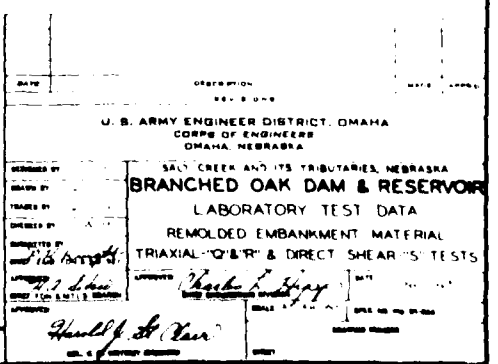


FIGURE 8



THIS PLAN ACCOMPANIES CONTRACT NO DA-25-066-eng MODIFICATION NO

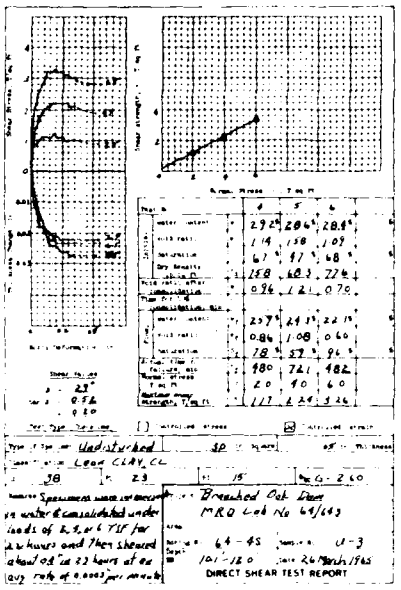


FIGURE 1

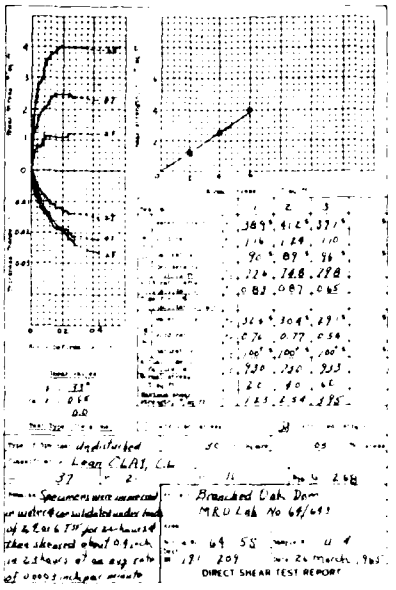


FIGURE 2

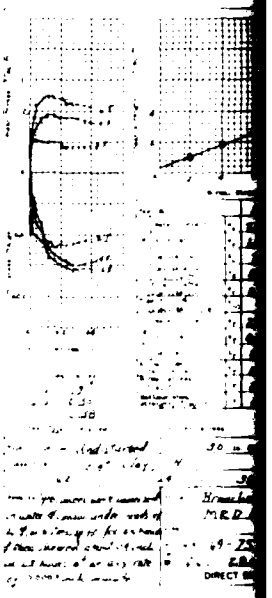


FIGURE 3

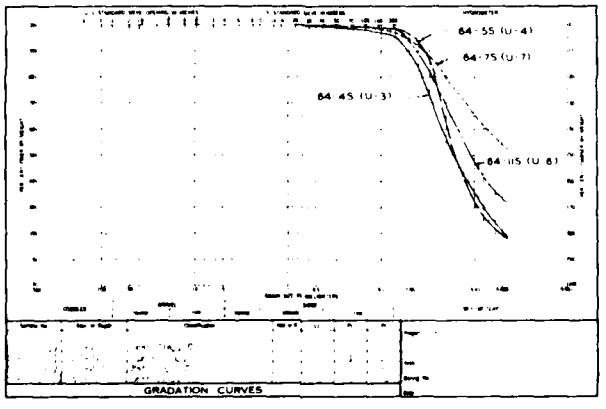
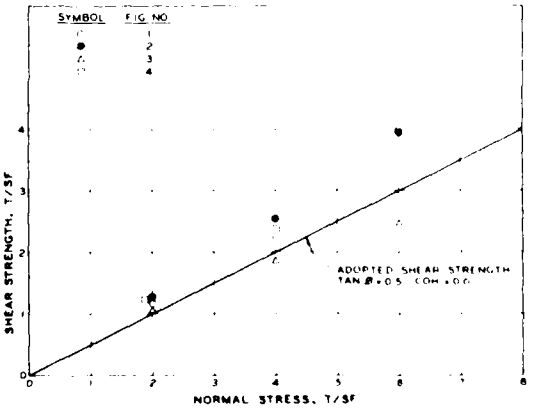


FIGURE 5



TEST SUMMARY

FIGURE 6

NOTE:

1. Test specimens were
and consolidated unde
6 T/SF for 22 hours
about 0.4" in 23 hour
rate of 0.0003 inches

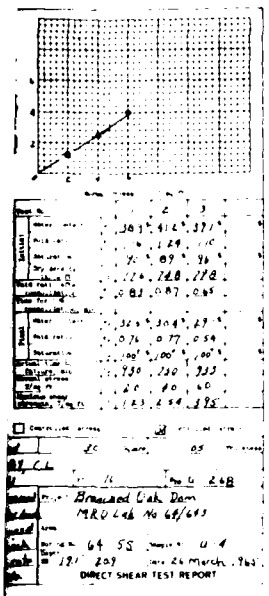


FIGURE 2

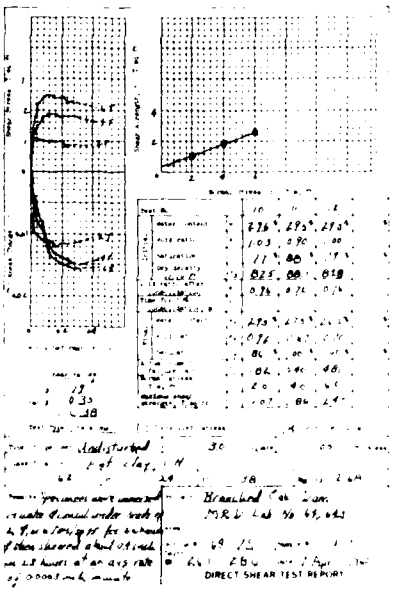


FIGURE 3

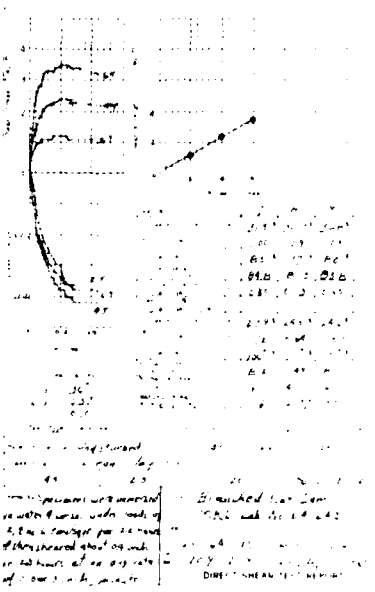
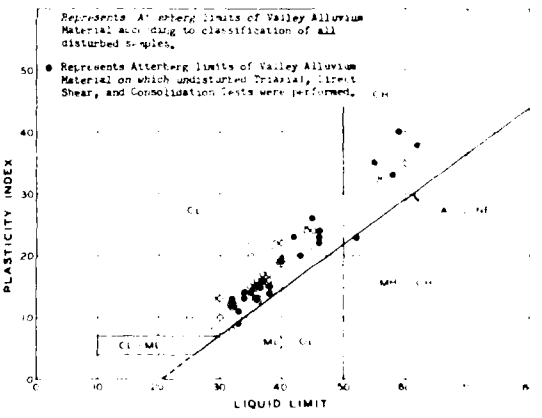
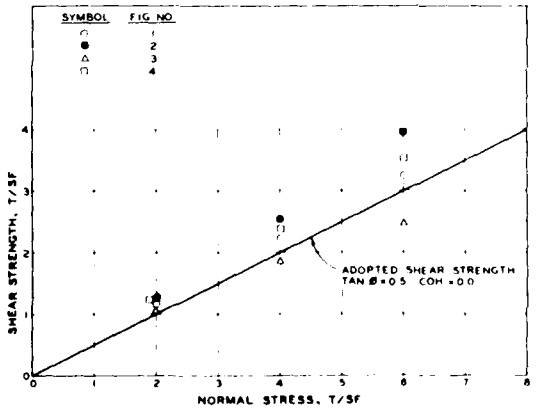


FIGURE 4



ATTERBERG LIMITS SUMMARY

FIGURE 7



TEST SUMMARY

FIGURE 6

NOTE:

1. Test specimens were immersed in water and consolidated under loads of 2,4,or 6 T/SF for 22 hours and then sheared about 0.4" in 23 hours at an average rate of 0.0003 inches per minute.

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

SALT CREEK AND ITS TRIBUTARIES, NEBRASKA

BRANCHED OAK DAM & RESERVOIR

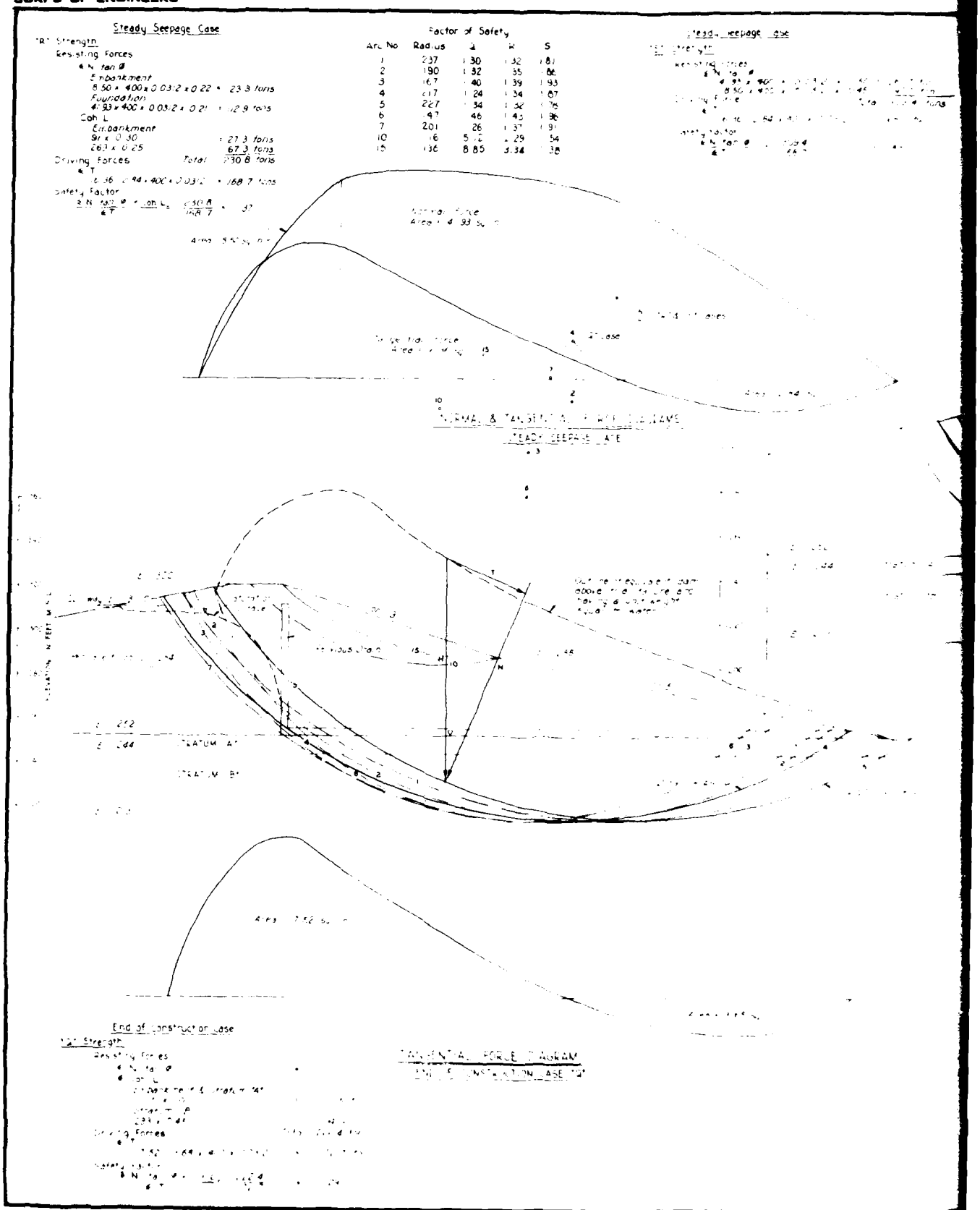
LABORATORY TEST DATA

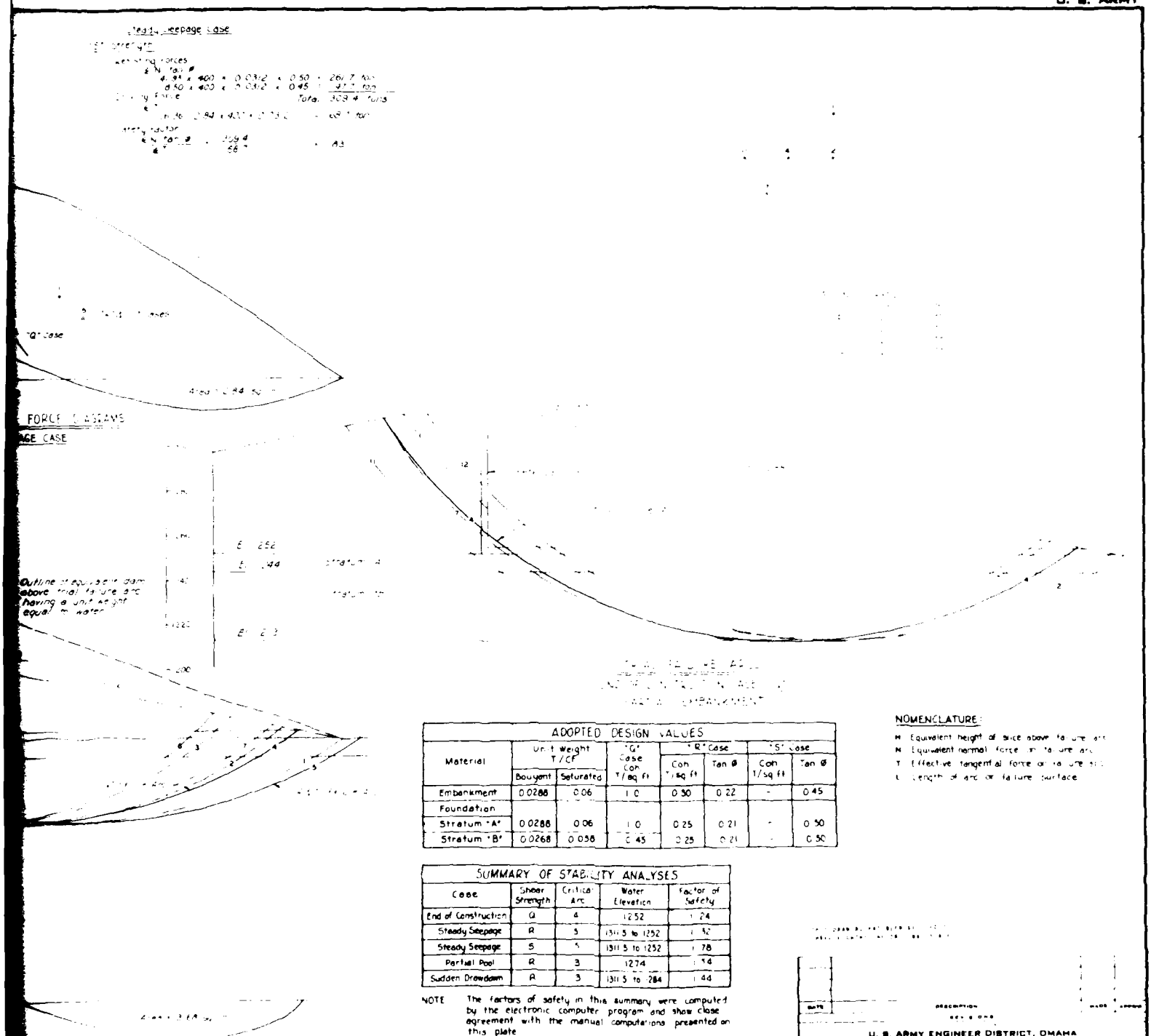
DIRECT SHEAR-"S" TESTS

THIS PLAN ACCOMPANIES CONTRACT NO DA-25-066-eng MODIFICATION NO

EMBANKMENT CRITERIA AND PERFORMANCE REPOPT (1983) PLATE A25

CORPS OF ENGINEERS





ADOPTED DESIGN VALUES							
Material	Unit Weight T/CF		"G" Case Coh T/sq ft	"R" Case		"S" Case	
	Bouyant	Saturated		Coh T/sq ft	Tan Ø	Coh T/sq ft	Tan Ø
Embankment	0.0288	0.06	1.0	0.30	0.22	-	0.45
Foundation							
Stratum "A"	0.0288	0.06	1.0	0.25	0.21	-	0.50
Stratum "B"	0.0268	0.058	0.45	0.25	0.21	-	0.50

NOMENCLATURE

M Equivalent height of slice above failure arc
N Equivalent normal force on failure arc
T Effective tangential force on failure arc
L Length of arc or failure surface

SUMMARY OF STABILITY ANALYSES				
Case	Shear Strength	Critical Arc	Water Elevation	Factor of Safety
End of Construction	Q	4	1252	1.24
Steady Seepage	R	3	1311.5 to 1252	1.52
Steady Seepage	S	5	1311.5 to 1252	1.78
Partial Pool	R	3	1274	1.54
Sudden Drawdown	R	3	1311.5 to 284	1.44

NOTE The factors of safety in this summary were computed by the electronic computer program and show close agreement with the manual computations presented on this plate

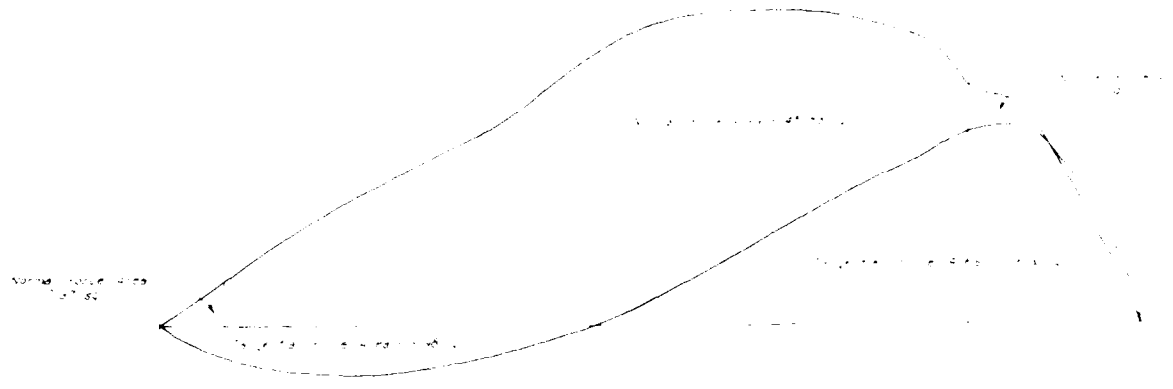
A27

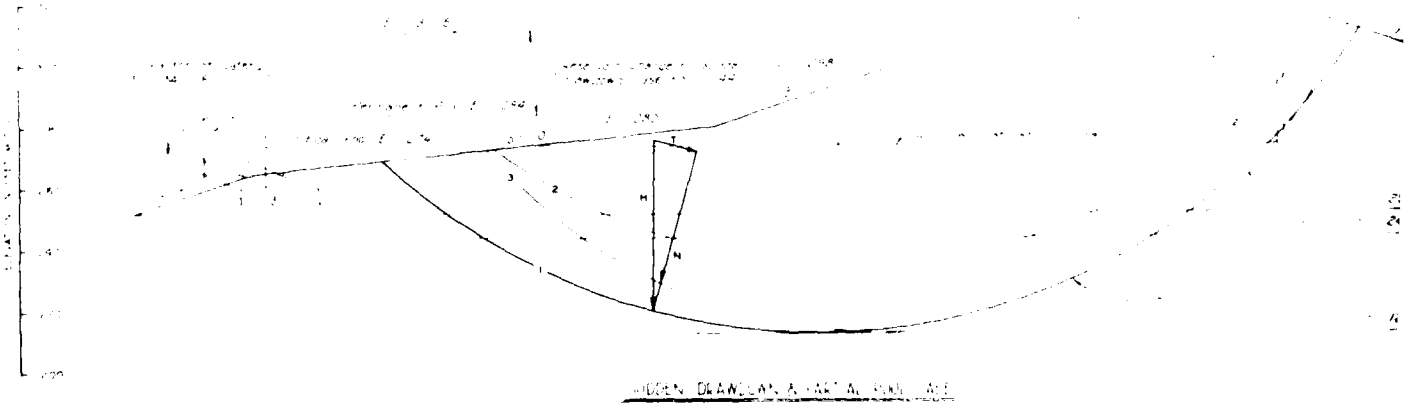
U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

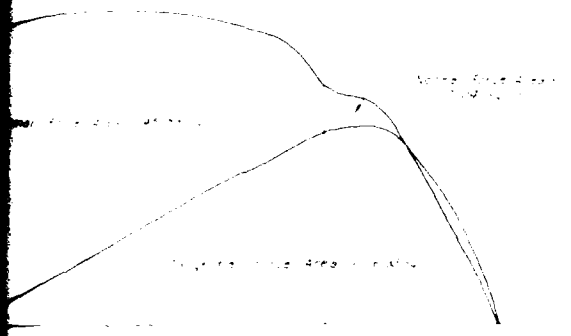
SALT CREEK AND ITS TRIBUTARIES, NEBRASKA
BRANCHED OAK DAM & RESERVOIR
STABILITY ANALYSES
CIRCULAR ARC METHOD
CONSTRUCTION AND SEEPAGE CASES

SCALE 1 INCH = 20 FEET

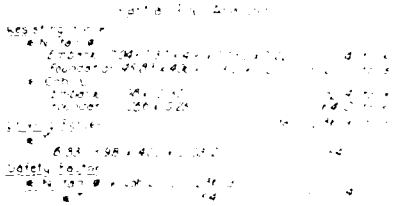
THIS PLAN ACCOMPANIES CONTRACT NO. DA-25-065-eng MODIFICATION NO.

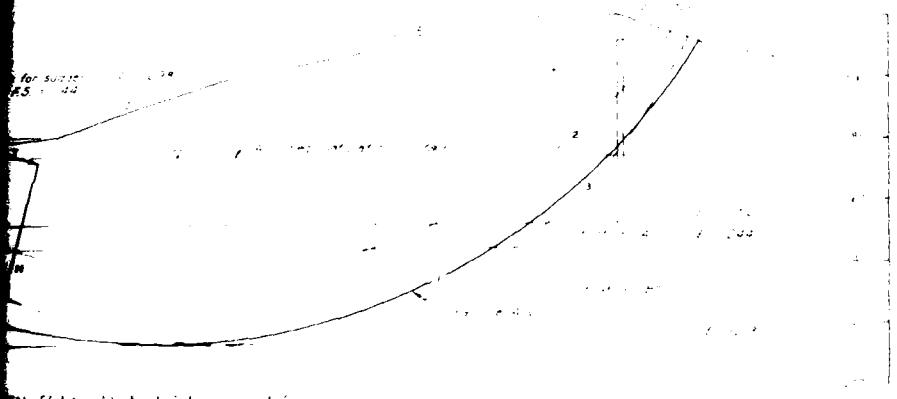






NGENT A





NOMENCLATURE:

H Equivalent height of soil above failure surface
N Equivalent normal force per foot of failure surface
T Effective tangential force per foot of failure surface
L Length of arc of failure surface

Note For adopted design values see plate 42a

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

SALT CREEK AND ITS TRIBUTARIES, NEBRASKA

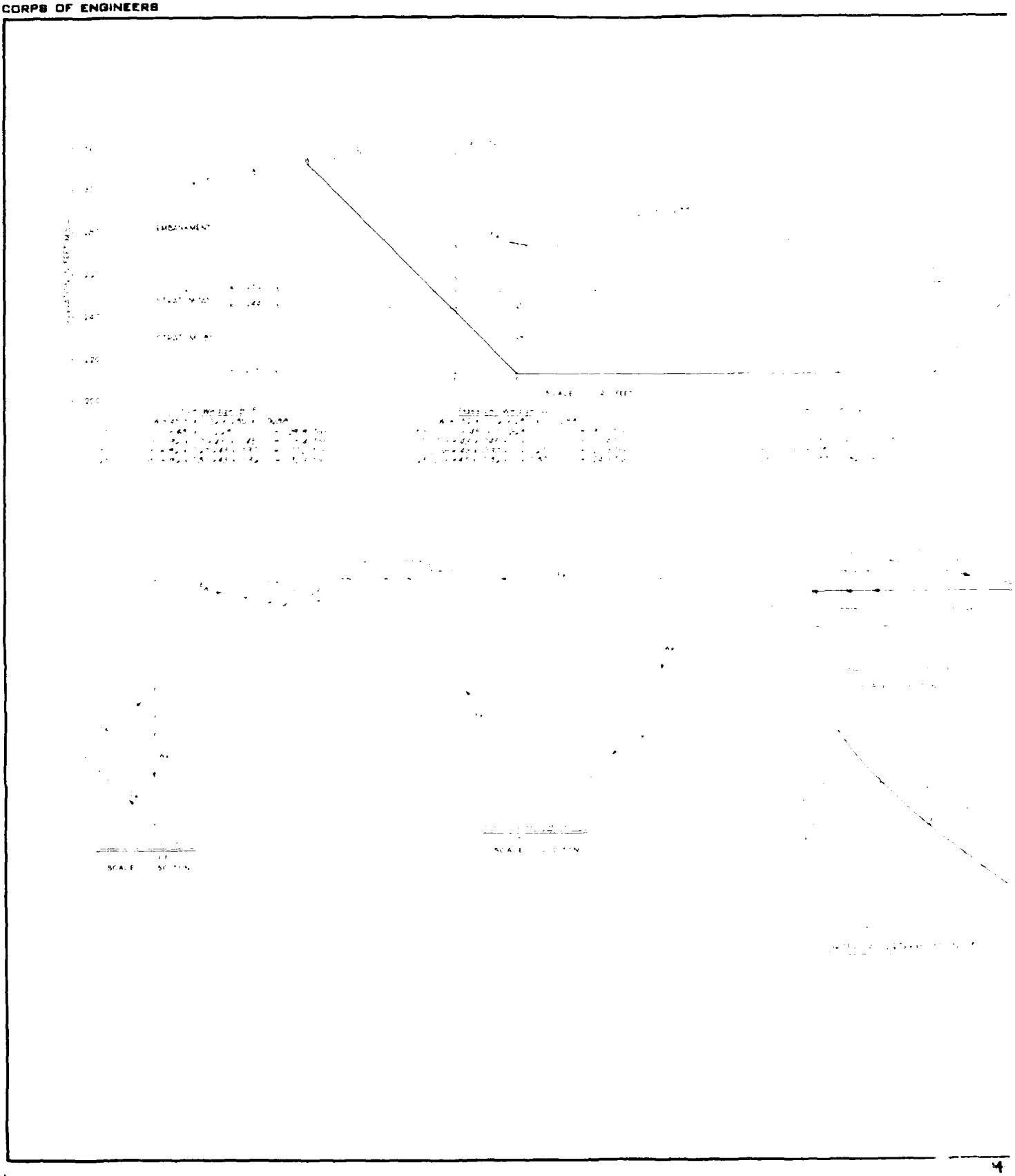
BRANCHED OAK DAM & RESERVOIR

STABILITY ANALYSES
CIRCULAR ARC METHOD
SUDDEN DRAWDOWN AND
PARTIAL POOL CASES

SCALE 1 INCH = 30 FEET
30 0 30

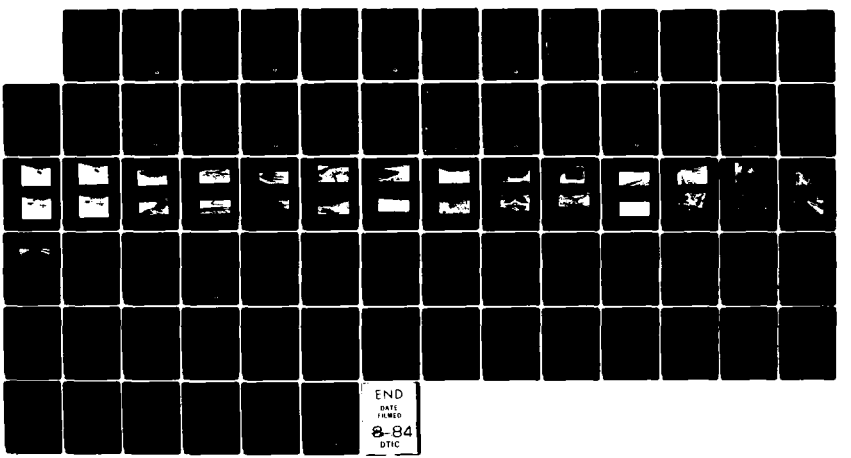
THIS PLAN ACCOMPANIES CONTRACT NO. DA-25-066-eng-
MODIFICATION NO

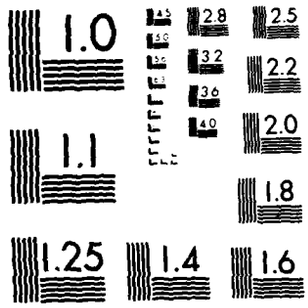
SAFETY DAYS



AD-A142 769 EMBANKMENT CRITERIA AND PERFORMANCE REPORT SALT CREEK AND TRIBUTARIES NEBRASKA SITE 18 BRANCHED OAK DAM AND LAKE(U) CORPS OF ENGINEERS OMAHA NE MAY 84 2/2

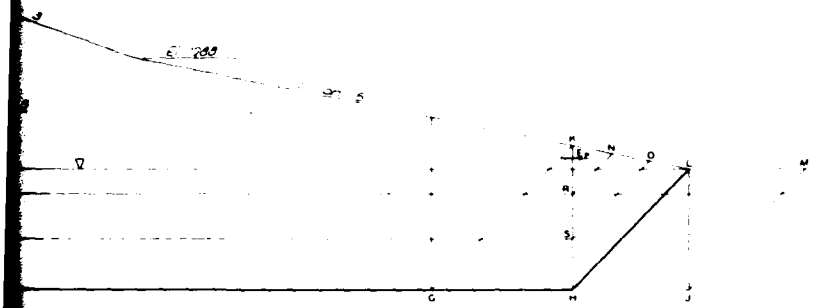
UNCLASSIFIED F/G 13/13 NL





MATERIAL	ADOPTED DESIGN VALUES			
	UNIT WT (T/CF)		"Q" STRENGTH	
	BOUYANT	SATURATED	Coh (T/SQ FT)	Tan ϕ
Embankment	0.0288	0.06	1.0	.00
Foundation				
Stratum "A"	0.0288	0.06	.10	.00
Stratum "B"	0.0268	0.058	.045	.00

SUMMARY OF STABILITY ANALYSES	
Slide Plane	F of S
BF-L	.25
BF-M	.5
BF-R	.5
AE-L	1
AE-M	.25
AE-R	.25
EF-L	.25
EF-R	.25

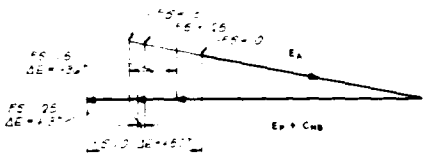


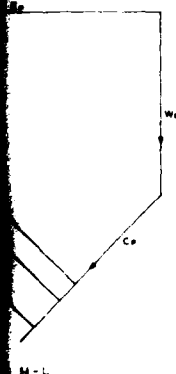
SCALE 1" = 20 FEET

Neutral Block F-H

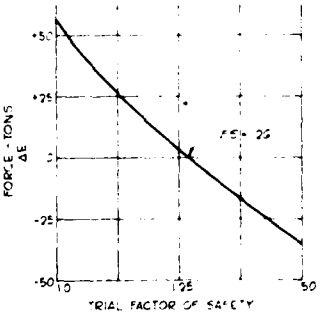
.0288
= 30 Ton
= 30.4 Ton
= 20.3 Ton
= 24.3 Ton

FS			
.10	Coh = 99 x .045	= 4.9	Tons
.5	Coh = 99 x .030	= 5.9.7	Tons
.25	Coh = 99 x .036	= 7.0	Tons





Neutral Block F-H
Force Polygon
SCALE 1" = 30 TON



GRAPHICAL DETERMINATION OF F.S.

NOMENCLATURE

- C - Cohesion per unit area
- C_D - Cohesion developed per unit area
  = Cohesion / Assumed F.S.
- E_A - Resultant earth forces of active wedge
- E_{NB} - Resultant earth forces of neutral block
- E_P - Resultant earth forces of passive wedge
- ΔE - Difference between active and passive forces
- F.S. - Factor of Safety
  = Shear strength assumed / Shear strength developed at equilibrium
- W_A - Weight of active wedge
- W_P - Weight of passive wedge
- F_A OR F_P - Effective force on the slide plane and the direction in which it is acting.

THIS DRAWING HAS BEEN REDUCED TO THREE-EIGHTHS THE ORIGINAL SCALE.

DATE	DESCRIPTION	MADE	APPD
	REVISIONS		

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

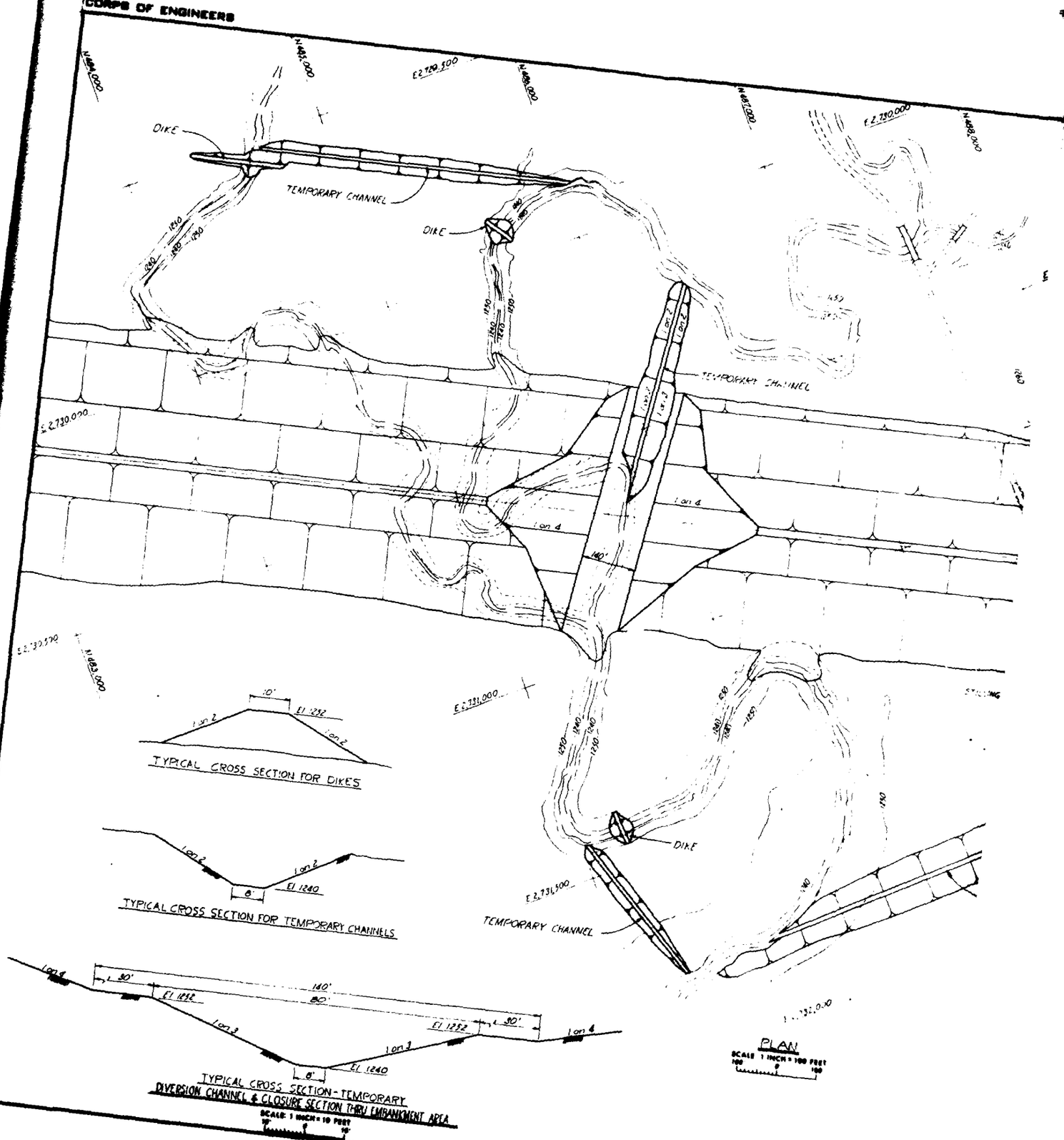
SALT CREEK AND ITS TRIBUTARIES, NEBRASKA
BRANCHED OAK DAM & RESERVOIR
STABILITY ANALYSES
WEDGE METHOD
END OF CONSTRUCTION CASE

DESIGNED BY: E O N
DRAWN BY: L D C
TRACED BY: L D C
CHECKED BY: C W H
RECOMMENDED: Charles E. Hoff
DATE: DEC 1968
APPROVED: Chief, Engineering Division
SCALE: AS SHOWN

THIS PLAN ACCOMPANIES CONTRACT NO. DA-25-066-civ. MODIFICATION NO.

SAFETY PAYS

CORPS OF ENGINEERS



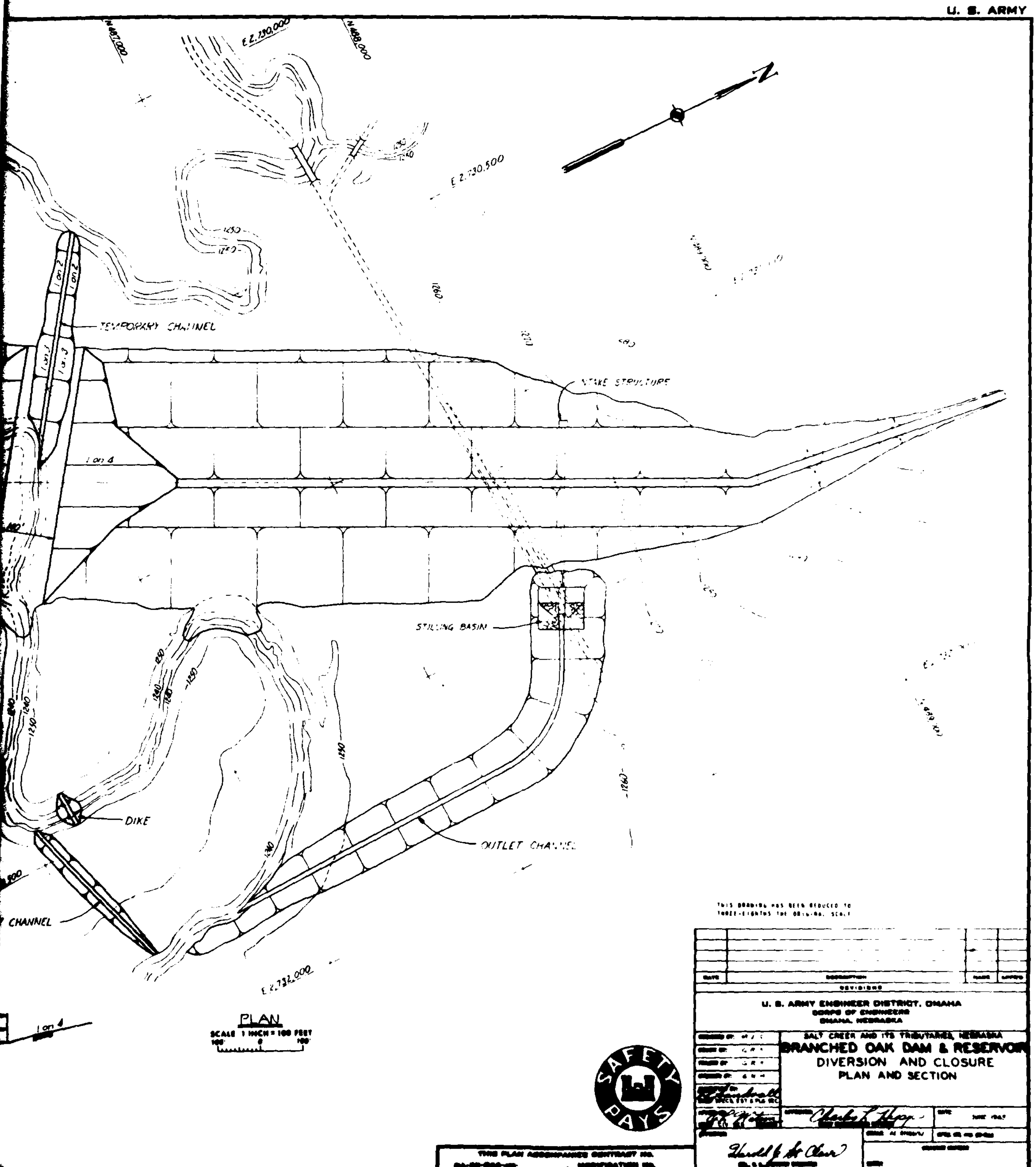
TYPICAL CROSS SECTION FOR DIKES

TYPICAL CROSS SECTION FOR TEMPORARY CHANNELS

TYPICAL CROSS SECTION - TEMPORARY DIVERSION CHANNEL & CLOSURE SECTION THRU EMBANKMENT AREA

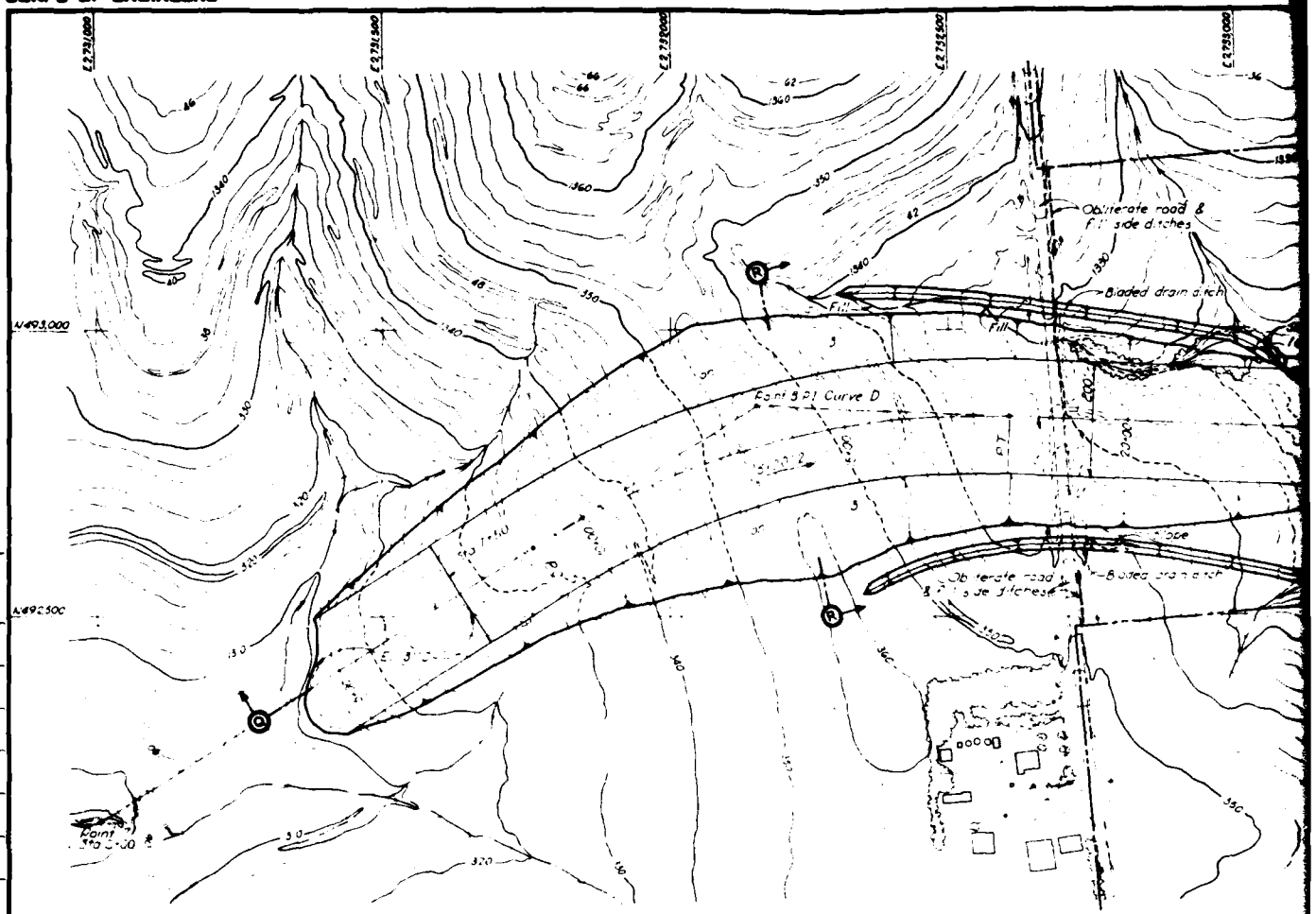
SCALE: 1 INCH = 10 FEET

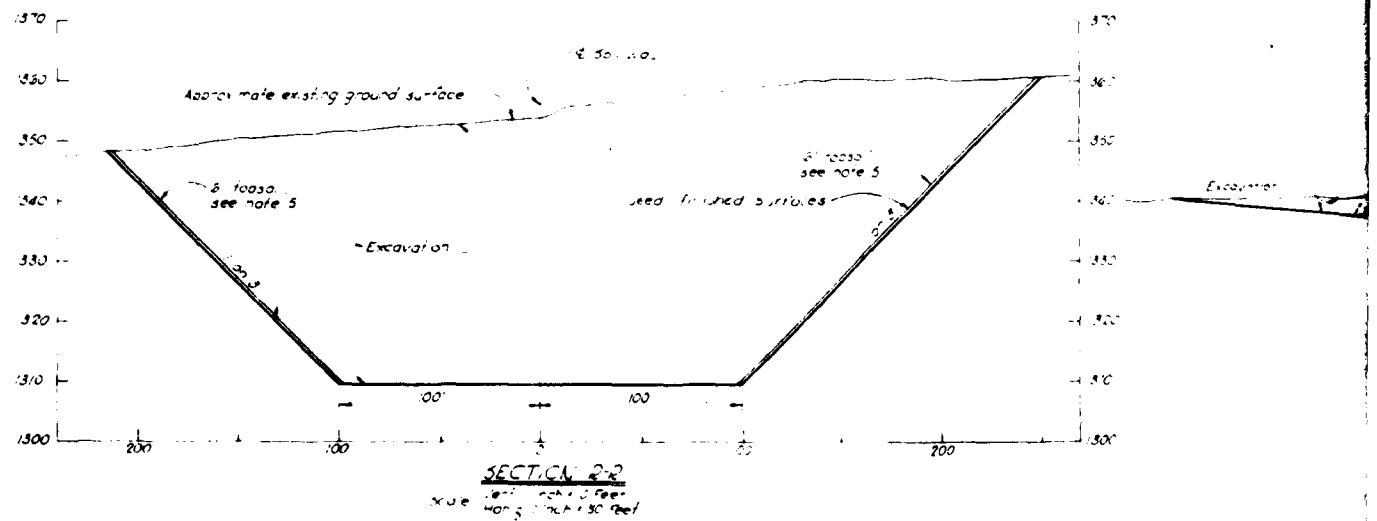
EMBANK



EMBANKMENT CRITERIA AND PERFORMANCE REPORT (1983) PLATE A29

CORPS OF ENGINEERS

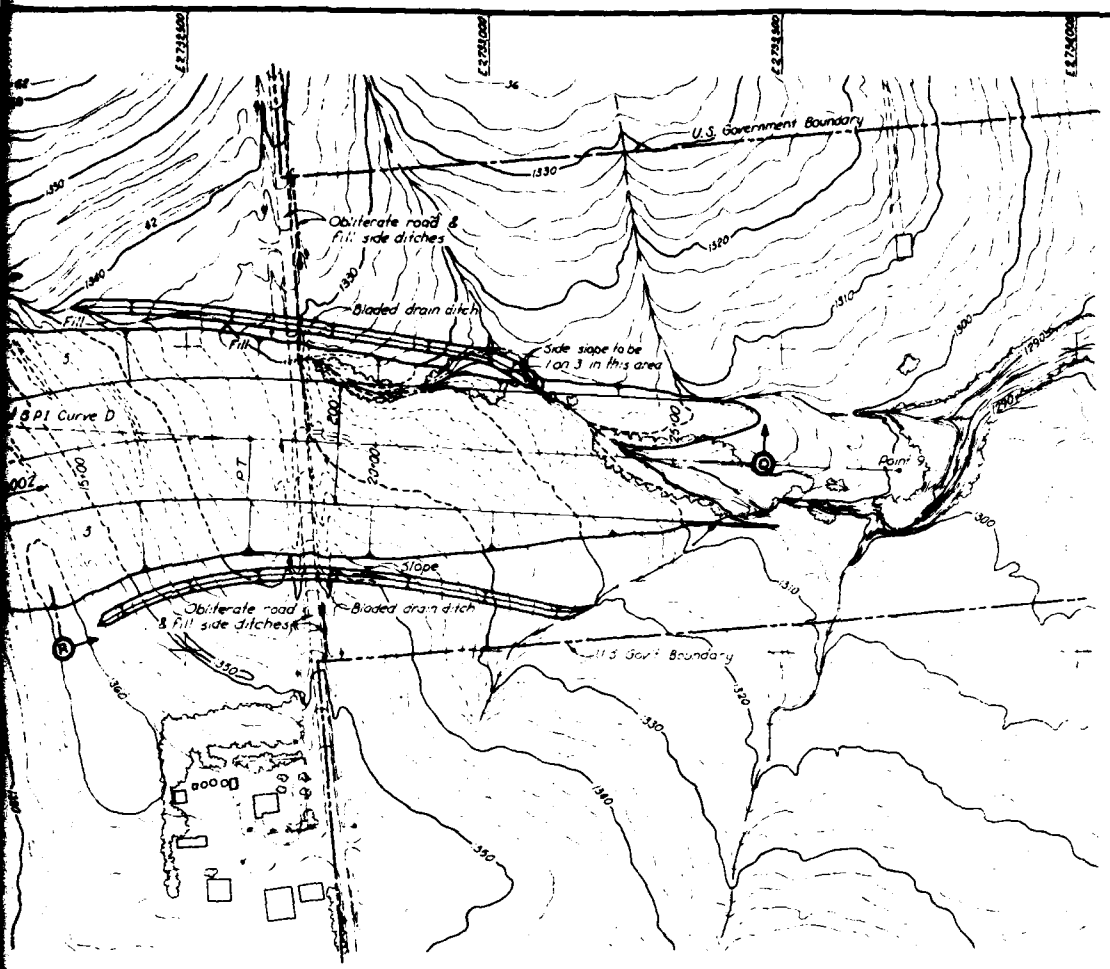




A 105 Nonnegative Film or A Paper Reproducible Record Copy Must Be Made Before Every Addendum and/or Modification

ADDENDUM NO.	
DATE	
MODIFICATION	
DATE	

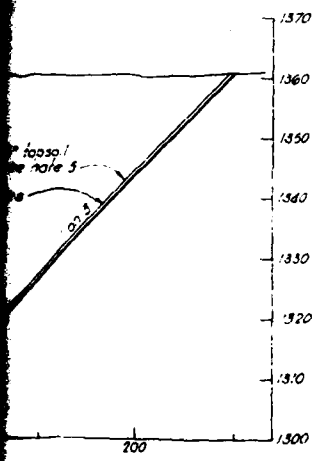
U. S. ARMY

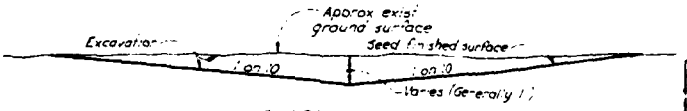


THIS DRAWING HAS BEEN REDUCED TO THREE-EIGHTHS THE ORIGINAL SCALE.

PLAN

SCALE: 1 INCH = 100 FEET





BLADED DRAIN DITCH

No Scale

GENERAL NOTES:

1. Bladed drain ditches alignment and grade to be established in the field approximately one foot deep with 1 on 10 side slopes. Construct small fills where necessary adjacent to top of Spillway side slope to prevent drainage down Spillway Slope.
2. Where Spillway excavation cuts natural Terraces, provide necessary earthwork to prevent drainage down Spillway side slope.
3. All Elevations shown refer to feet above M.S.L., 1954 General Adjustment.
4. For Control Points, see PLATE A2.
5. Place 6" layer of topsoil on excavated 1 on 3 slopes of Spillway from bottom of Spillway to the top of the slope.

DATE	DESCRIPTION	MADE	APPVD
	REVISIONS		

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

SALT CREEK AND ITS TRIBUTARIES, NEBRASKA

BRANCHED OAK DAM AND LAKE
SITE NO. 18
SPILLWAY
GRADING PLAN AND SECTION

DESIGNED BY: F.A.S.
DRAWN BY: A.G.D.
TRACED BY:
CHECKED BY: L.J.S.

APPROVED: Chief, Engineering Division
DATE: JULY 1968

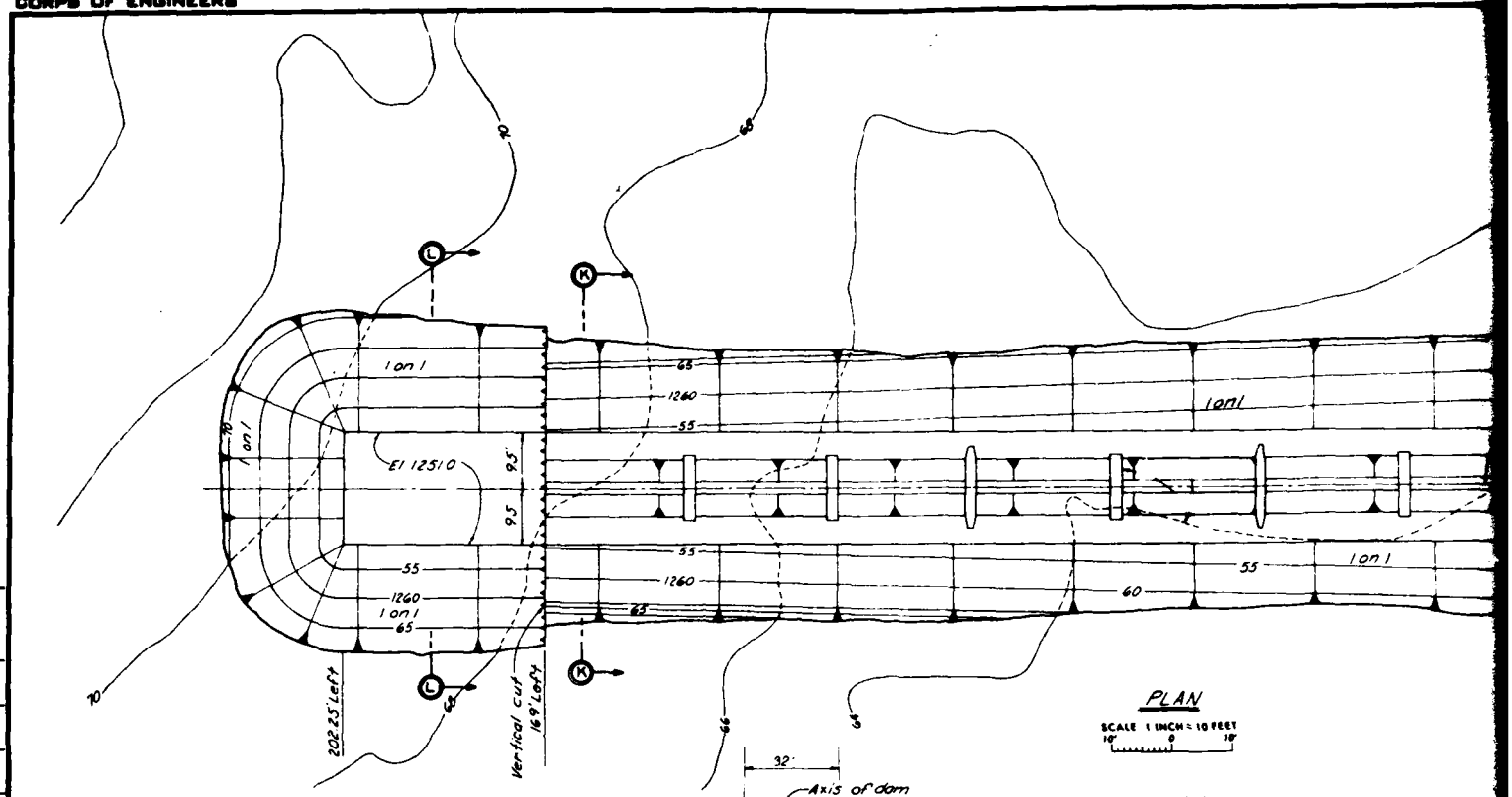
APPROVED: Col. C.E. District Engineer

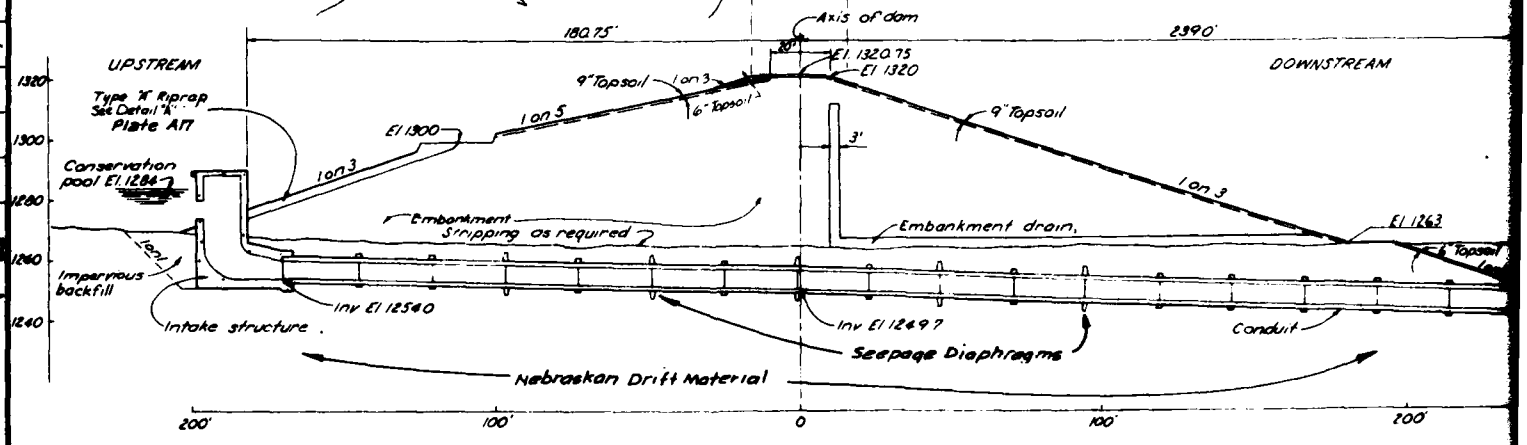
FIELD BK. NO.
SPEC. NO.
DRAWING NUMBER

THIS PLAN ACCOMPANIES CONTRACT NO.
MODIFICATION NO.

SAFETY PAYS

CORPS OF ENGINEERS





LONGITUDINAL SECTION THRU OUTLET WORKS

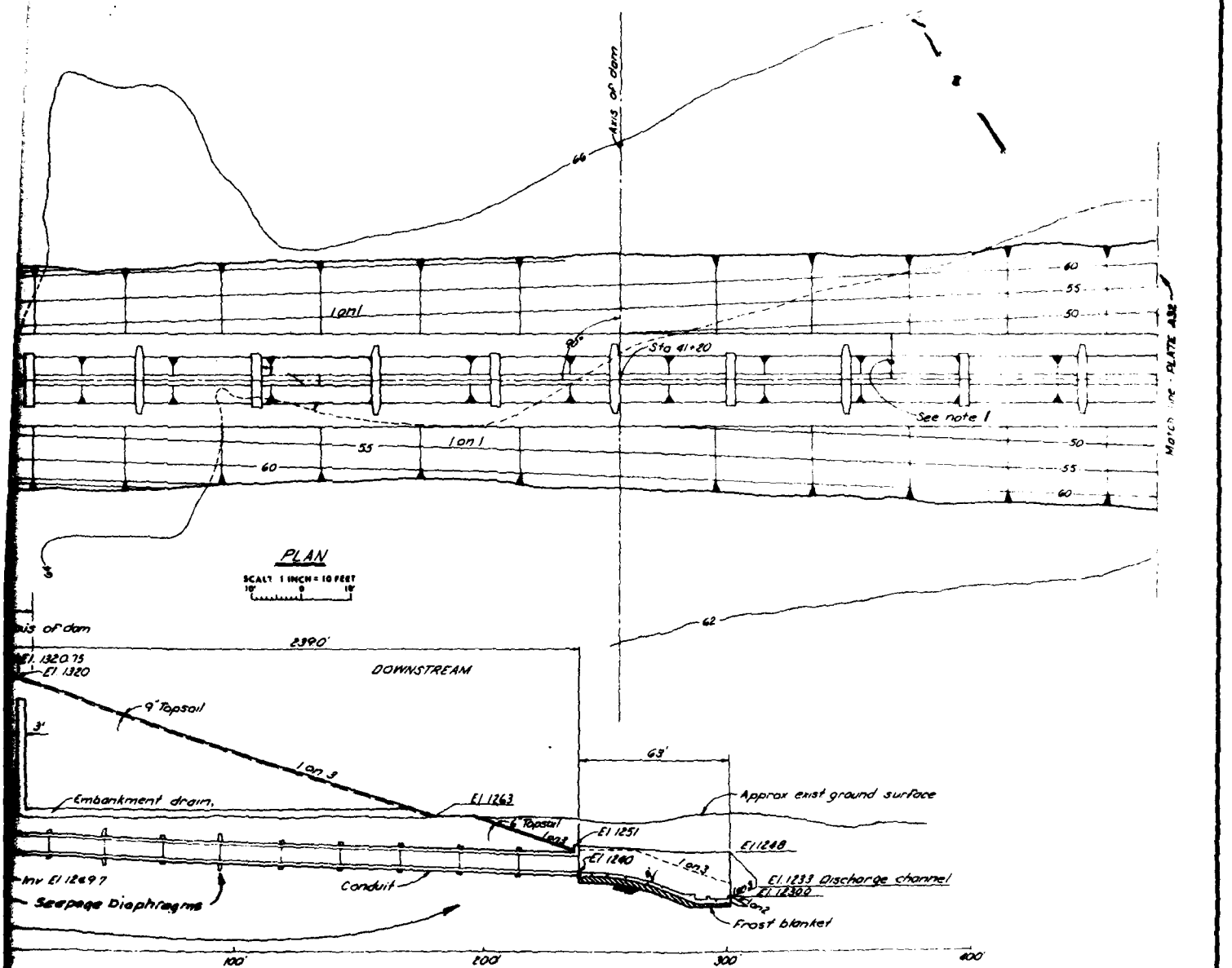
SCALE 1 INCH = 20 FEET

GENERAL NOTES:

1. 9.5' from ℄ conduit to slope at 0.5' above inver
2. For location of sectio
3. All elevations shown M.S.L., 1954 General Adj

EMBANKME

U. S. ARMY



W THRU OUTLET WORKS

GENERAL NOTES:

1. 9.5' from ℄ conduit to control for 1 on 1 slope at 0.5' above invert elevation.
2. For location of sections, see PLATE A33.
3. All elevations shown refer to feet above M.S.L., 1954 General Adjustment.

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

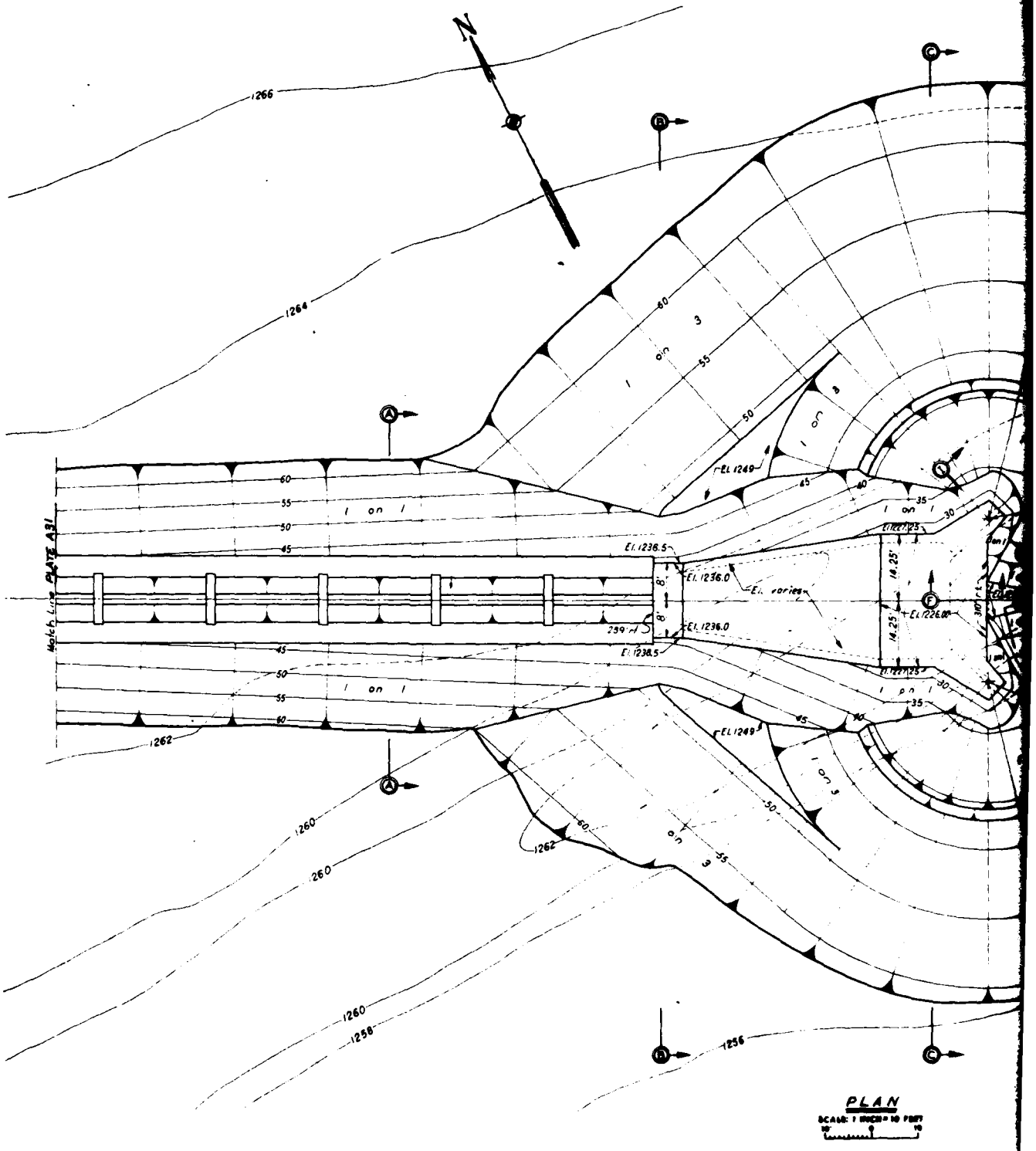
SALT CREEK AND ITS TRIBUTARIES, NEBRASKA
BRANCHED OAK DAM AND LAKE
SITE NO. 18
OUTLET WORKS
EXCAVATION PLAN - SHEET 1

DESIGNED BY R J M
DRAWN BY R F M
TRACED BY R F M
CHECKED BY L J S

FEB 1966

MSC13-310E7

2



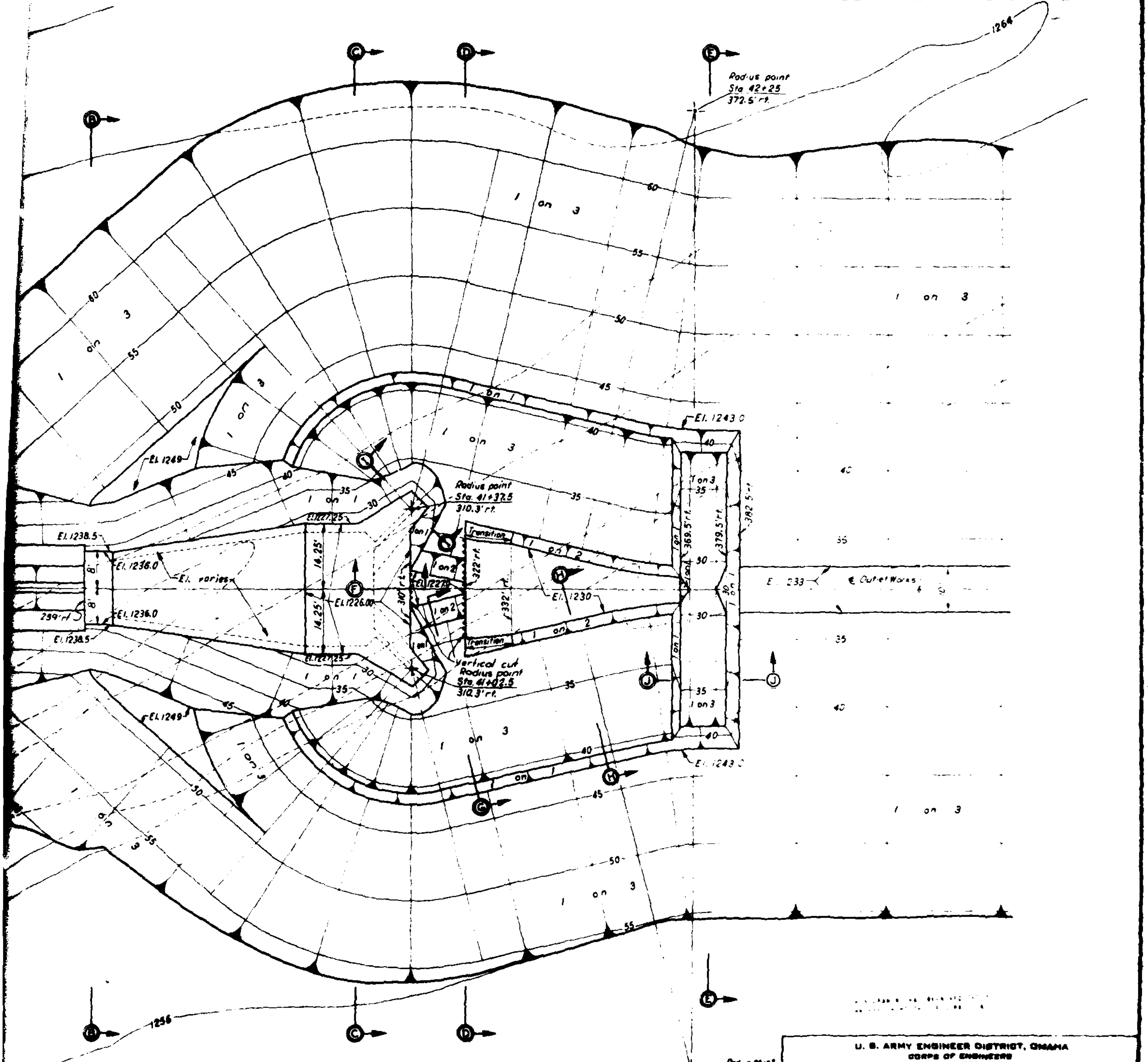
PLAN

SCALE: 1 INCH = 10 FEET

GENERAL NOTES:

1. All elevations shown thus in text are ...

U. S. ARMY



PLAN

SCALE: 1 INCH = 10 FEET

GENERAL NOTES:

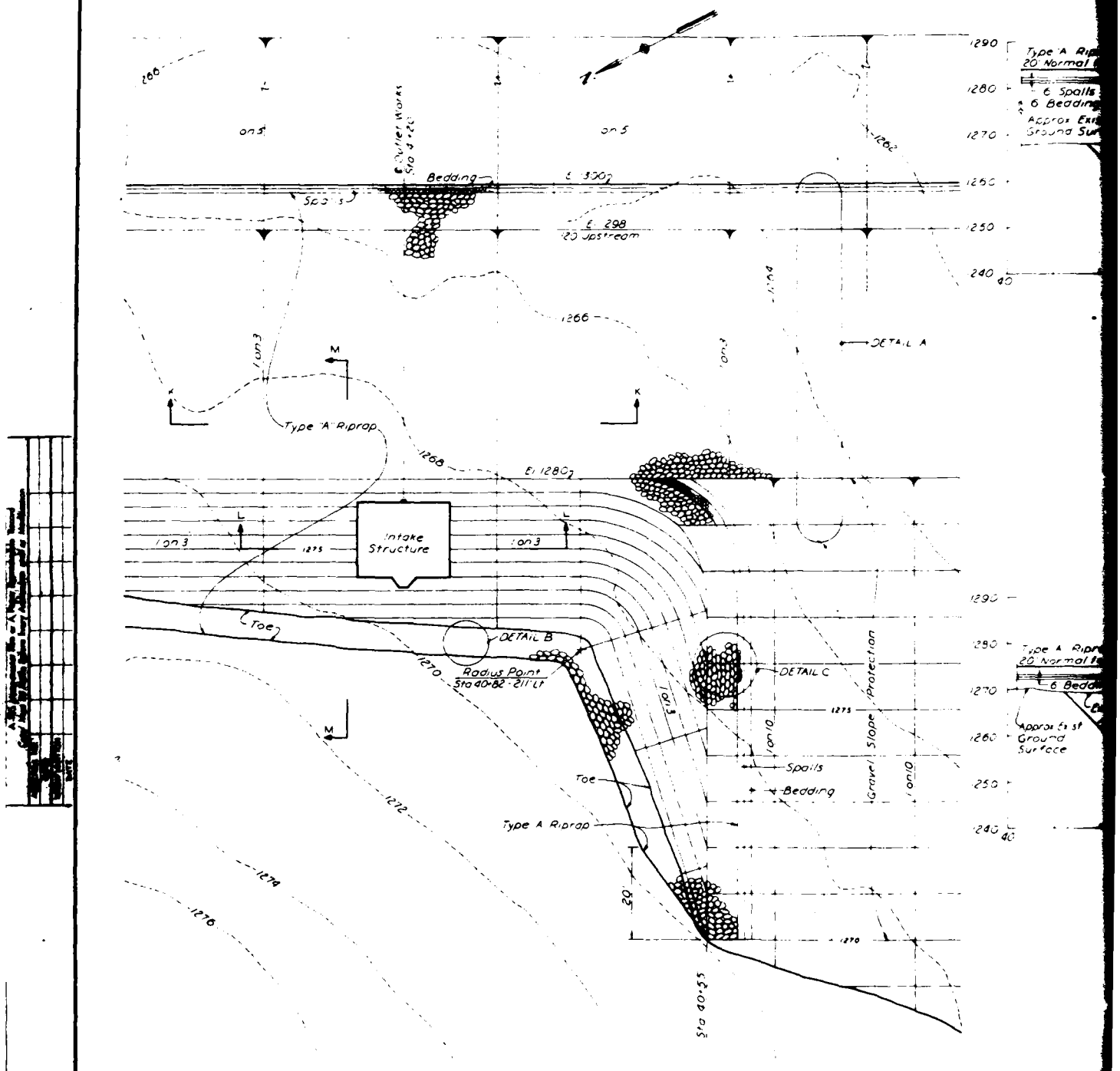
1. All elevations [illegible] in feet above M.S.L., 1954 General Adjustment.

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

SALT CREEK AND ITS TRIBUTARIES NEBRASKA
BRANCHED OAK DAM AND LAKE
SITE NO. 18
OUTLET WORKS
EXCAVATION PLAN-SHEET 2

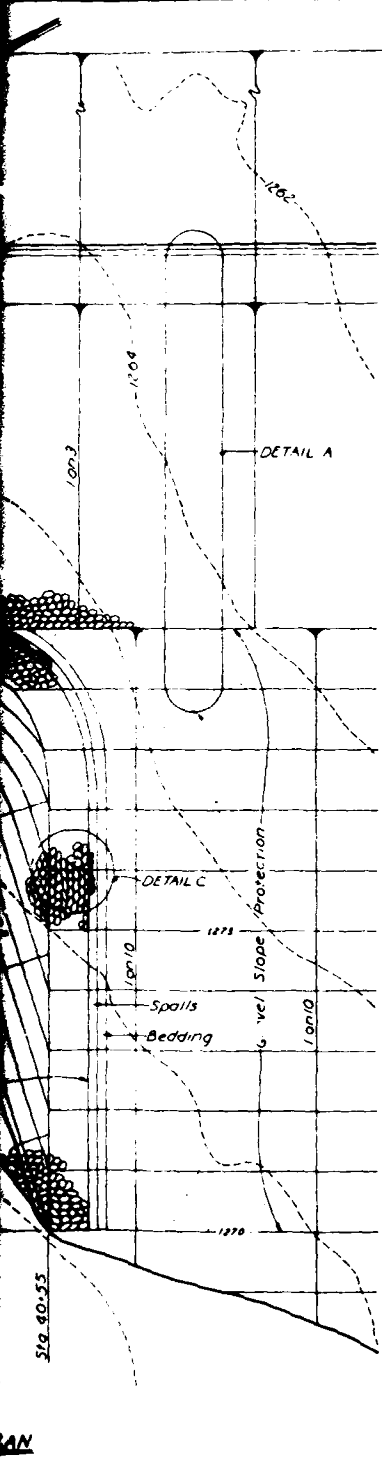
MSC13-310E3

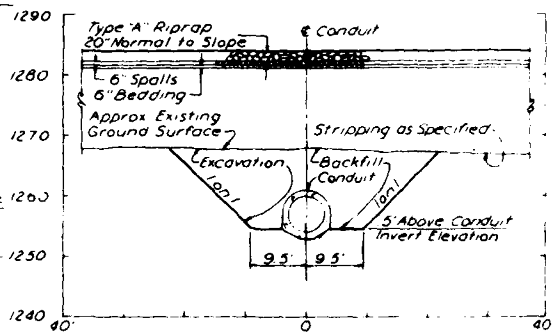
CORPS OF ENGINEERS



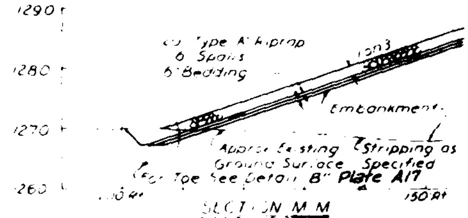
OUTLET WORKS EMBANKMENT PLAN

U. S. ARMY

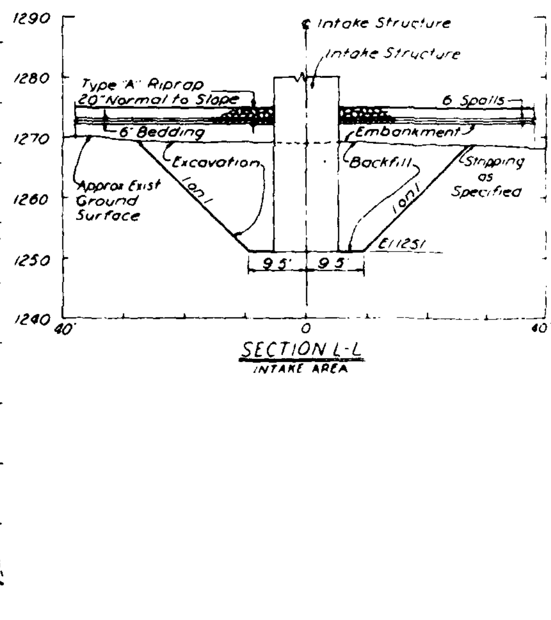




SECTION K-K
INTAKE AREA



SECTION M-M



SECTION L-L
INTAKE AREA

GENERAL NOTES:

1. All elevations shown refer to feet above M.S.L., 1954 General Adjustment.
2. Plan shows rock protection schedule. For soil cement schedule, see sections.
3. If the schedule for soil cement protection is constructed, the contractor may at his option use stone protection below elevation 1280 in order to provide a more continuous soil cement construction operation. See above detail

SCALE: 1 INCH = 10 FEET

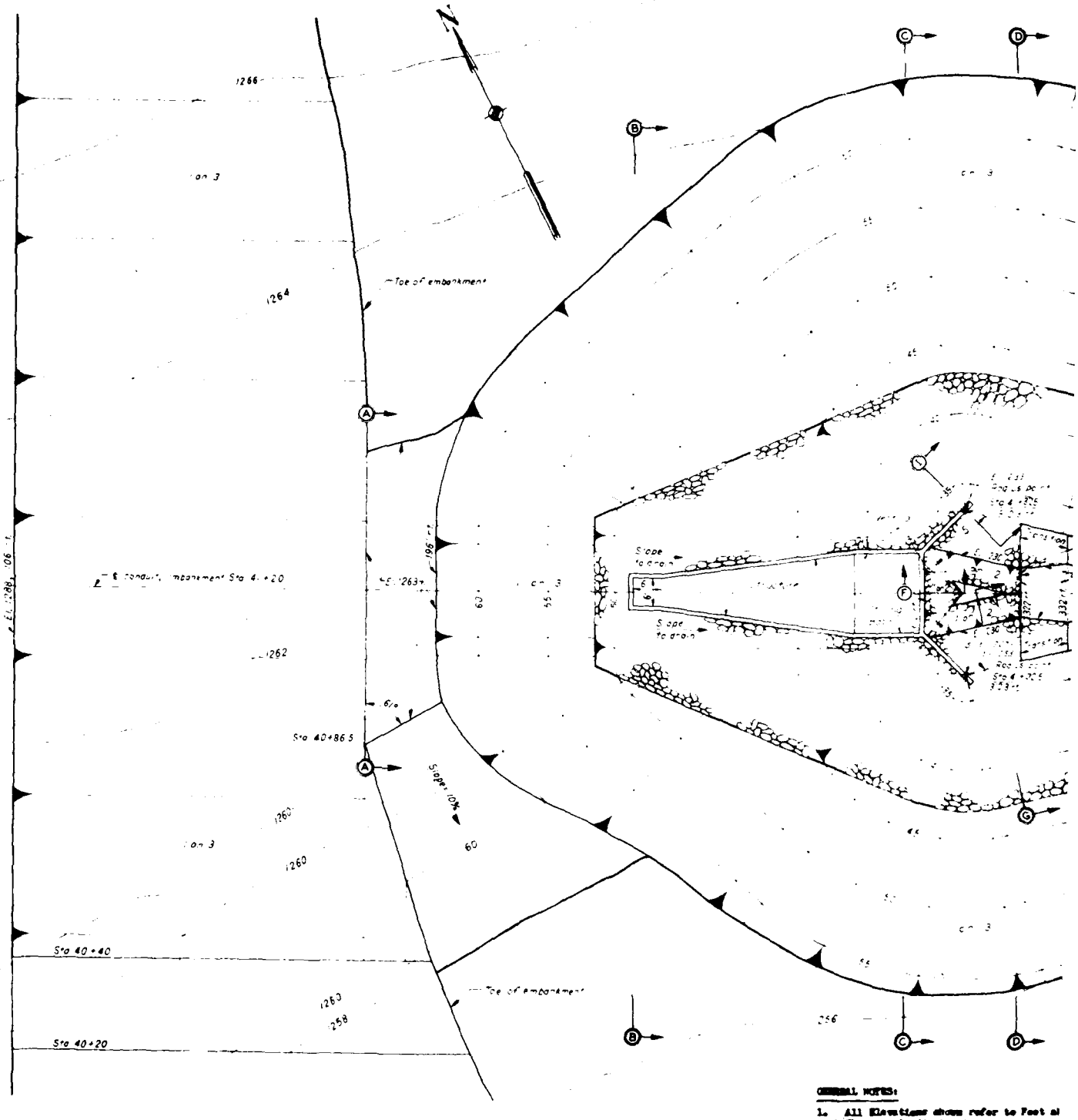
U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

SALT CREEK AND ITS TRIBUTARIES, NEBRASKA
BRANCHED OAK DAM AND LAKE
SITE NO. 18
OUTLET WORKS
EMBANKMENT PLAN AND SECTIONS
SHEET 1

FEB 1964

MSC13-31059

CORPS OF ENGINEERS



PLAN

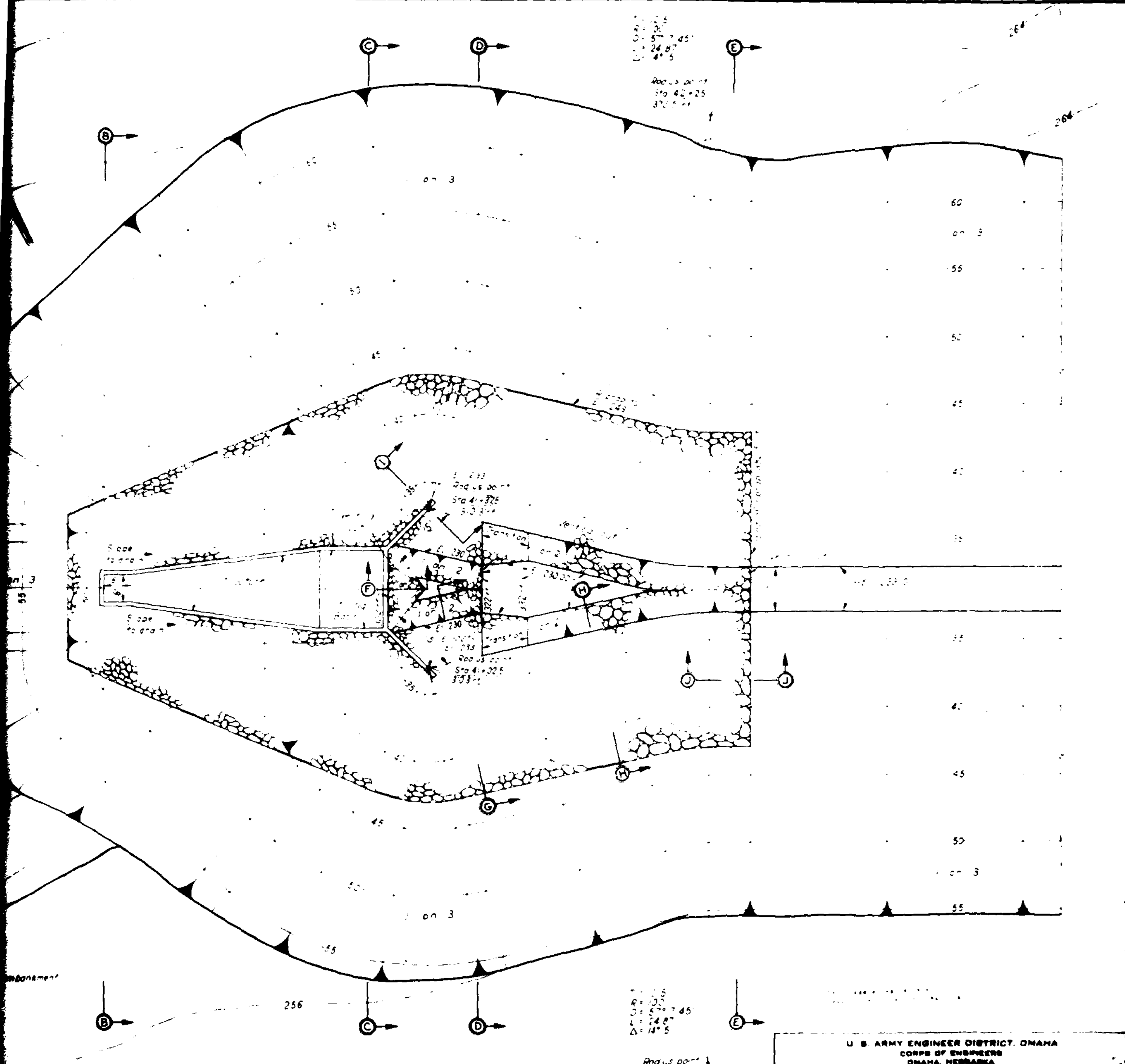
SCALE 1 INCH = 10 FEET

GENERAL NOTES:

1. All Elevations shown refer to Feet at 1954 General Adjustment.
2. For location of Sections, see PLATE
3. All distances shown as Ft., are measu Axis of Dam.

EMBANKME

U. S. ARMY



GENERAL NOTES:

1. All Elevations shown refer to Feet above M.S.L., 1954 General Adjustment.
2. For location of Sections, see PLATE A35.
3. All distances shown as Rt. are measured from Axis of Dam.

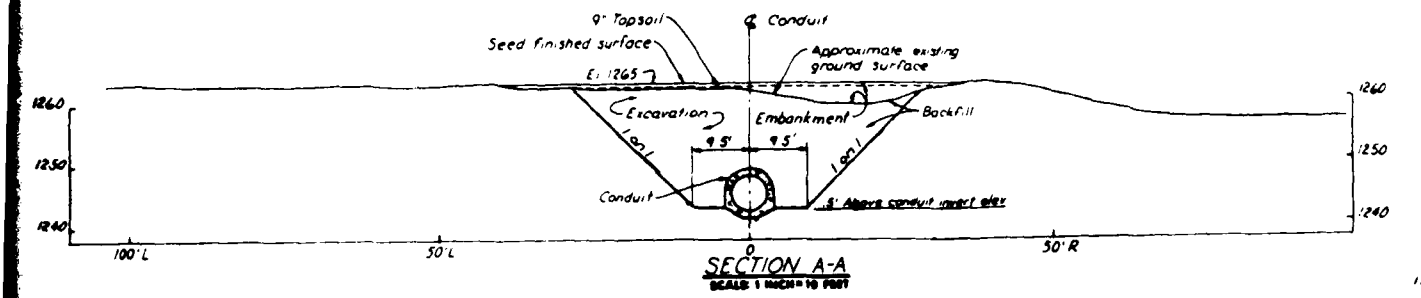
PLAN

SCALE 1 INCH = 10 FEET

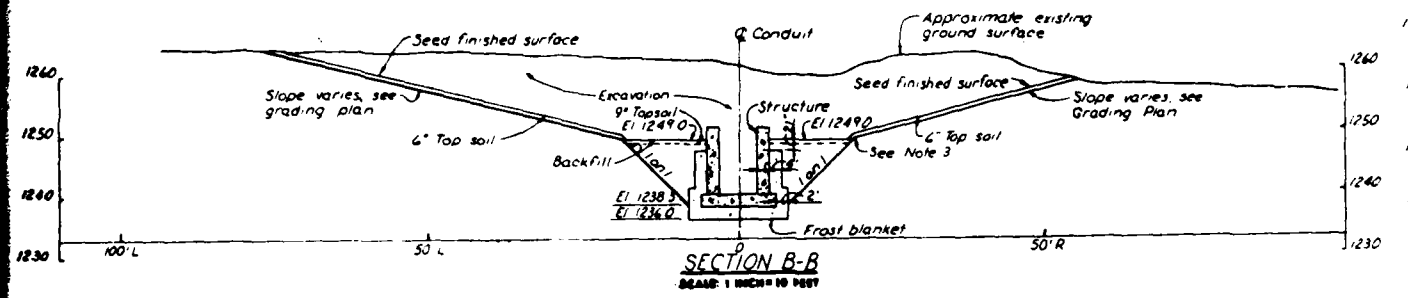
U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

BRANCHED OAK DAM AND LAKE
SITE NO. 18
OUTLET WORKS
EMBANKMENT PLAN – SHEET 2

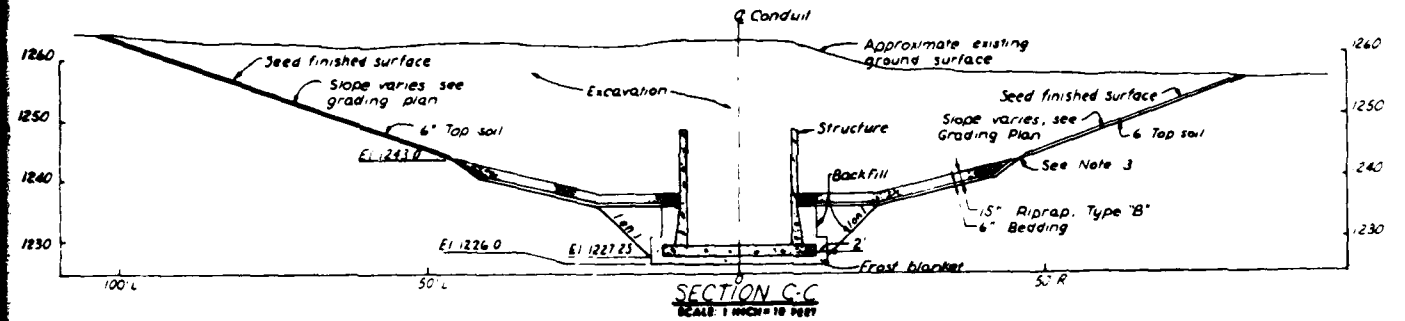
MSC18-310E10



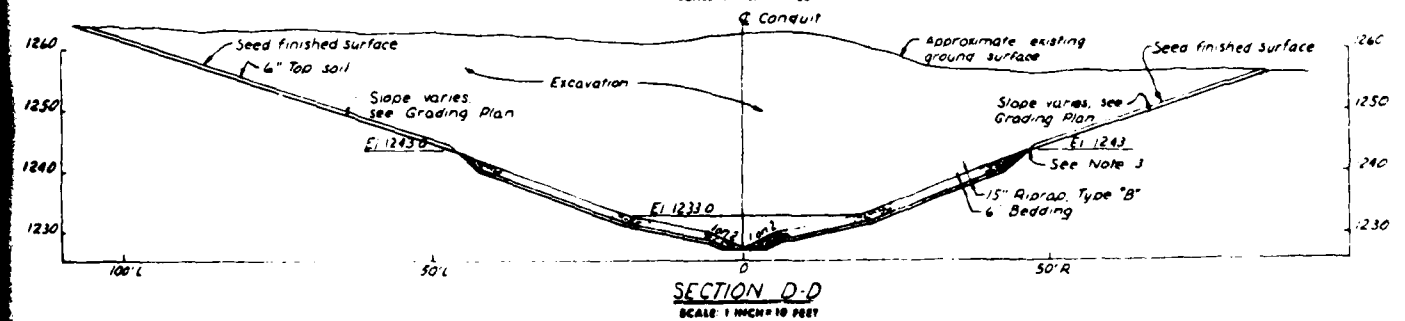
SECTION A-A
SCALE: 1 INCH = 10 FEET



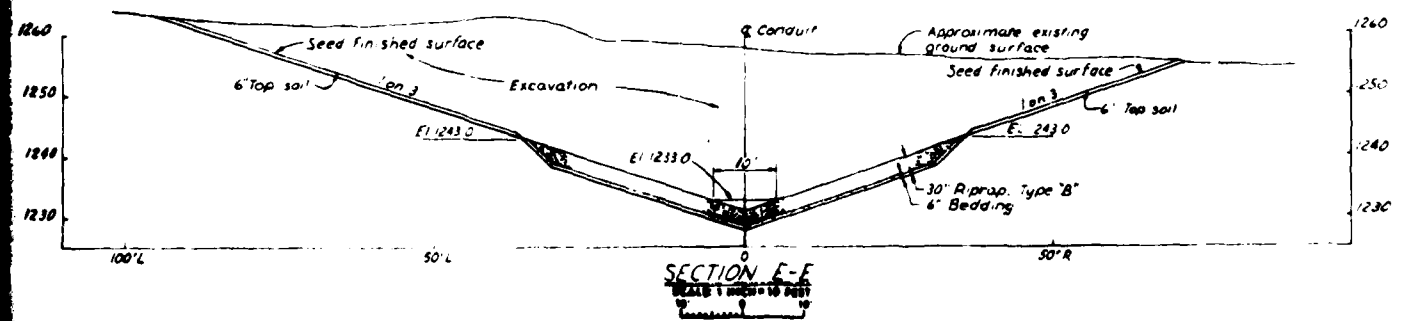
SECTION B-B
SCALE: 1 INCH = 10 FEET



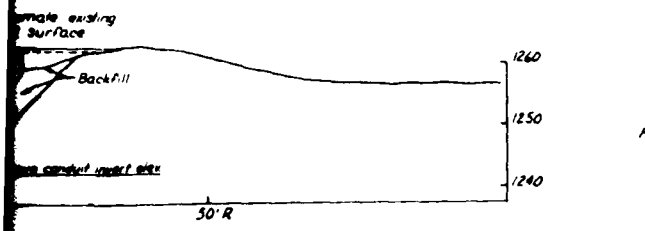
SECTION C-C
SCALE: 1 INCH = 10 FEET

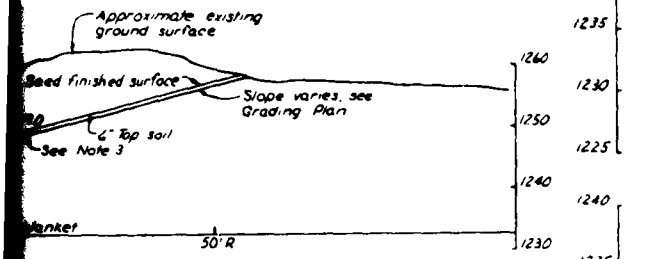


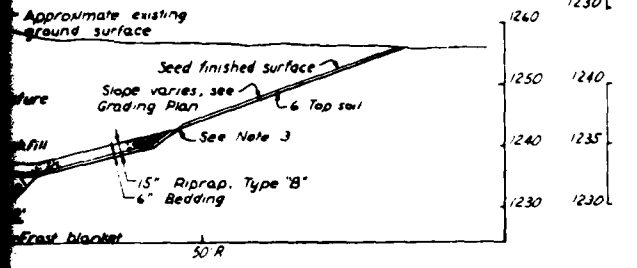
SECTION D-D
SCALE: 1 INCH = 10 FEET

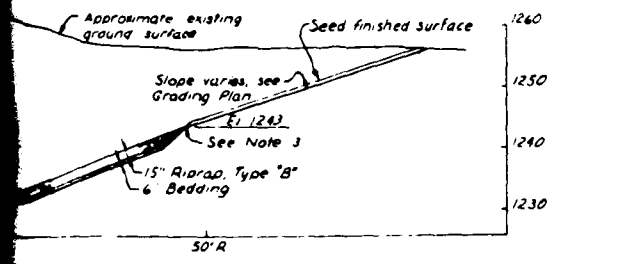


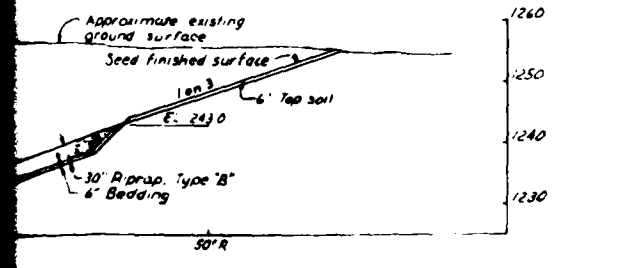
SECTION E-E
SCALE: 1 INCH = 10 FEET

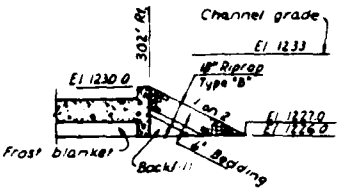




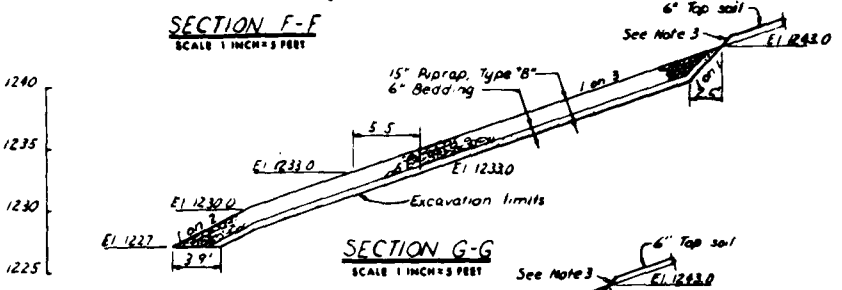




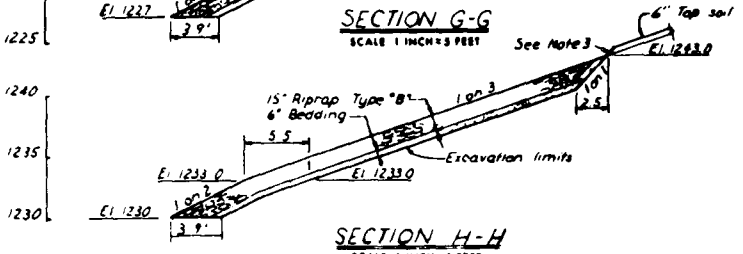




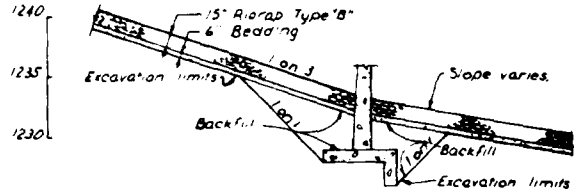
SECTION F-F
SCALE 1 INCH = 5 FEET



SECTION G-G
SCALE 1 INCH = 5 FEET



SECTION H-H
SCALE 1 INCH = 5 FEET



SECTION I-I
SCALE 1 INCH = 5 FEET

SECTION J-J
SCALE 1 INCH = 5 FEET
5 0 5

GENERAL NOTES:

1. All elevations shown refer to feet above M.S.L., 1954 General Adjustment.
2. For location of sections, See Plates A32 & A34.
3. Controls for grading are for unrevised slopes, topsoil shall be placed over excavated slopes and transitioned as necessary at contact between fill and excavation.

JULY 1970 REVISED FOR O & M

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

SALT CREEK AND ITS TRIBUTARIES, NEBRASKA
BRANCHED OAK DAM & RESERVOIR
OUTLET WORKS
SECTIONS

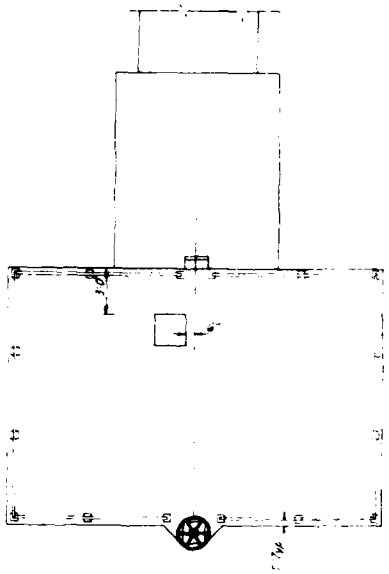
Charles E. Hoff

Edward J. McClean

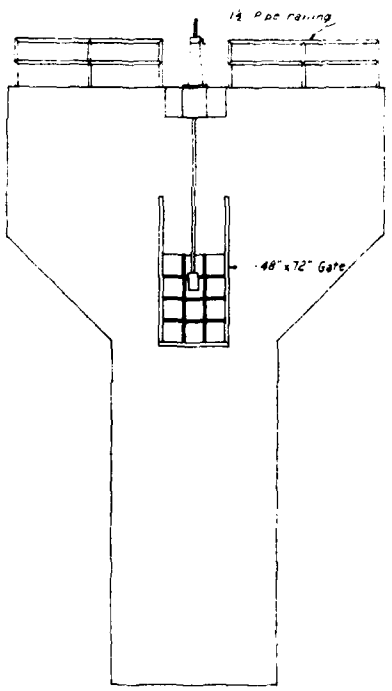
NCSCD-310211

SAFETY PAYS

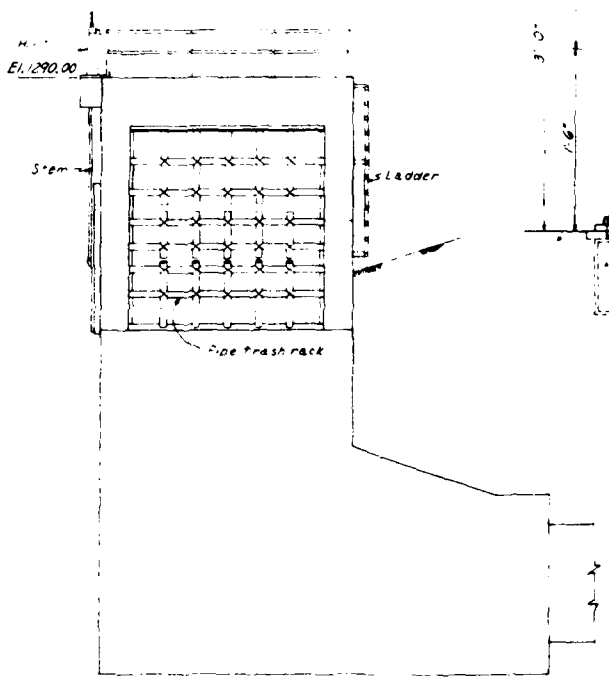
CORPS OF ENGINEERS



PLAN



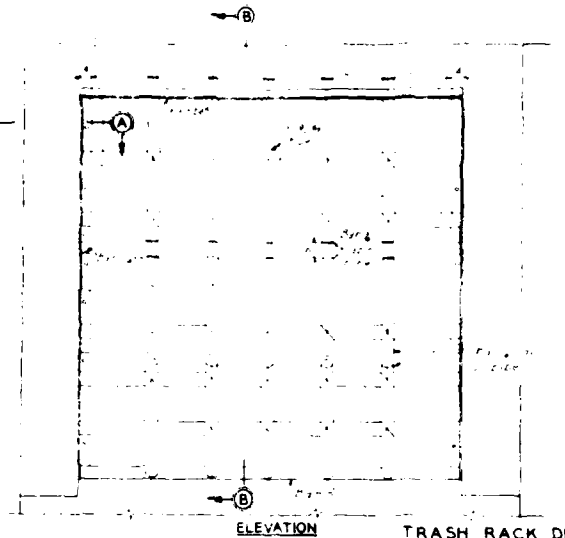
FRONT ELEVATION



SIDE ELEVATION

INTAKE STRUCTURE

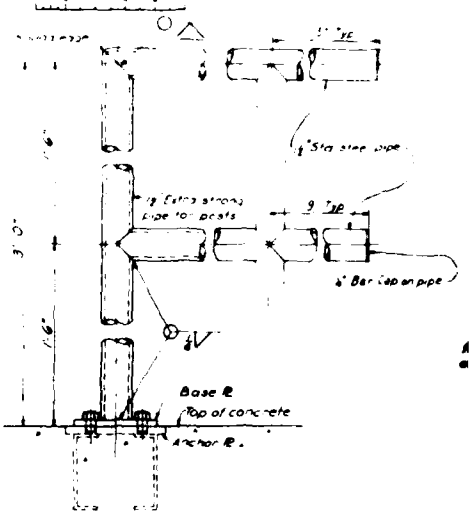
SCALE: ¼ INCH = 1 FOOT



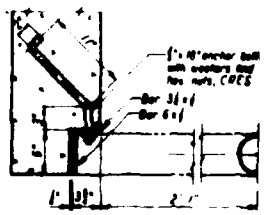
ELEVATION

TRASH RACK DETAILS

SCALE ½ INCH = 1 FOOT



ELEVATION

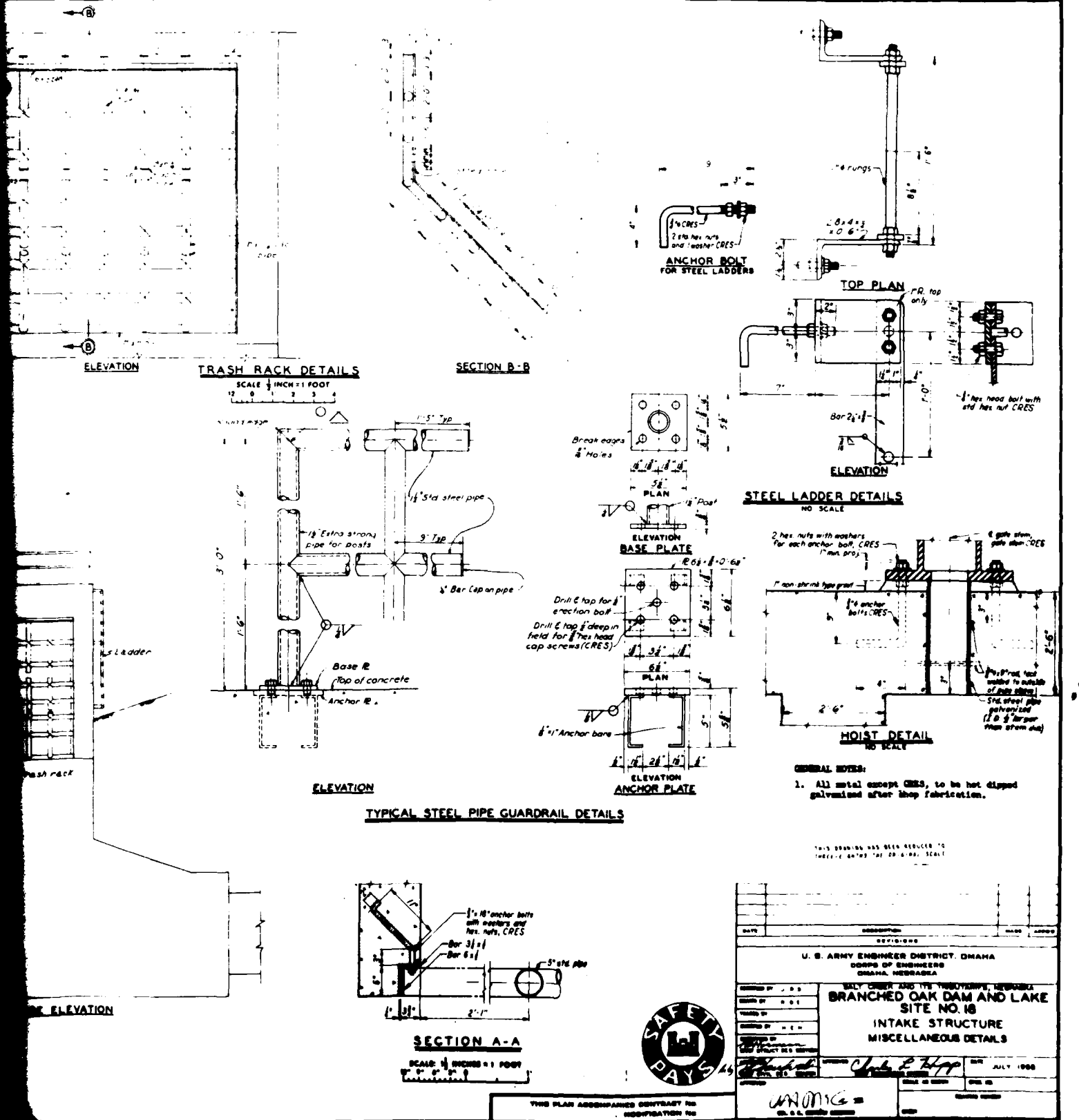


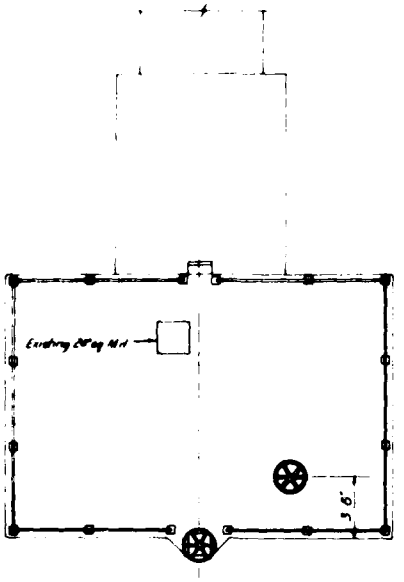
SECTION A-A

SECTION B-B

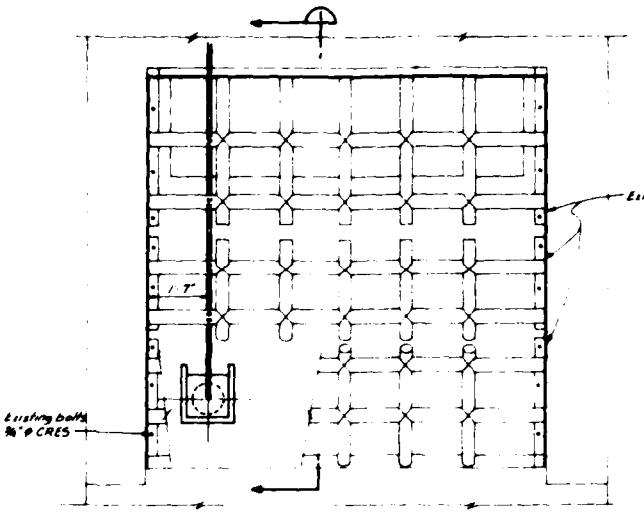
TYPICAL STEEL PIPE GUAR

EMBANKMENT

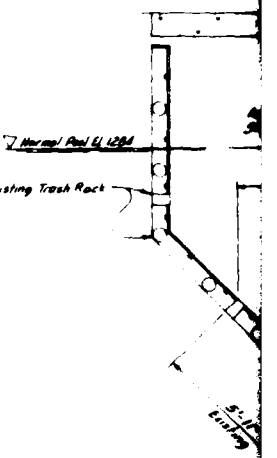

ELEVATION
TRASH RACK DETAILS
SCALE 1/2 INCH = 1 FOOT
SECTION B-B
ANCHOR BOLT FOR STEEL LADDERS
TOP PLAN
ELEVATION
STEEL LADDER DETAILS
NO SCALE
PLAN
ELEVATION
BASE PLATE
ELEVATION
ANCHOR PLATE
HOIST DETAIL
NO SCALE
ELEVATION
TYPICAL STEEL PIPE GUARDRAIL DETAILS
SECTION A-A
SCALE 1/2 INCHES = 1 FOOT
GENERAL NOTES:
1. All metal except CRES, to be hot dipped galvanized after shop fabrication.
U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA
BRANCHED OAK DAM AND LAKE
SITE NO. 18
INTAKE STRUCTURE
MISCELLANEOUS DETAILS
JULY 1968
SAFETY PAYS



PLAN

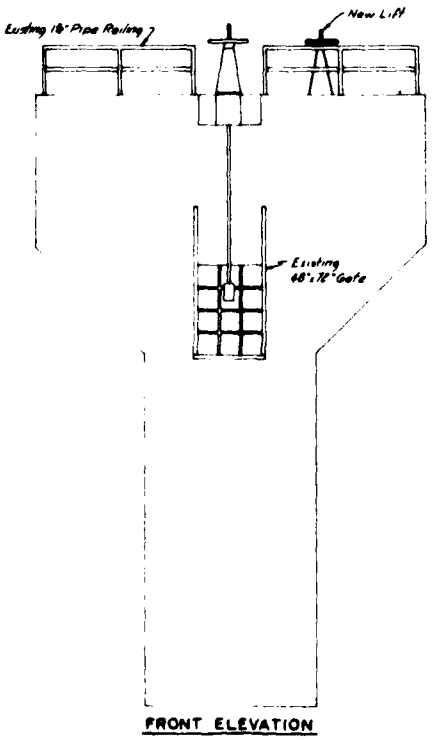


ELEVATION

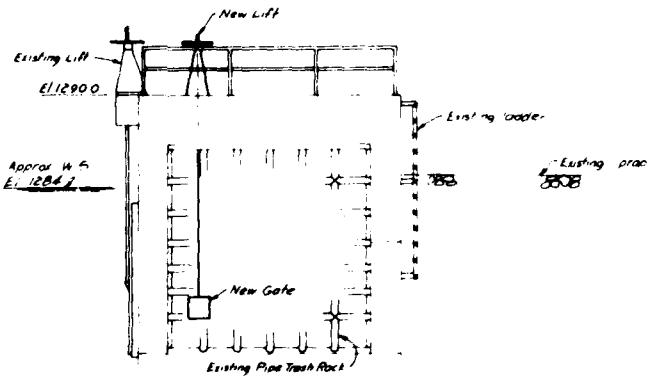


NEW GATE DETAIL

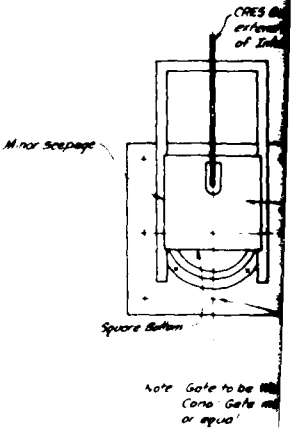
SCALE ½ INCH = 1 FOOT



FRONT ELEVATION

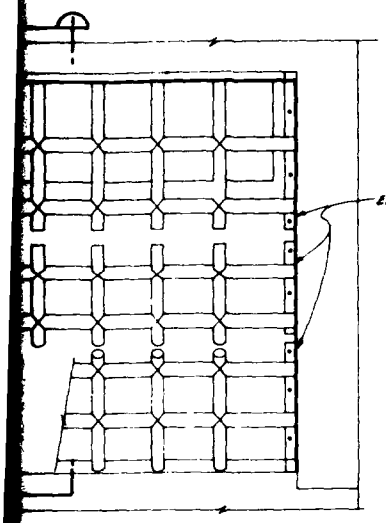


SIDE ELEVATION

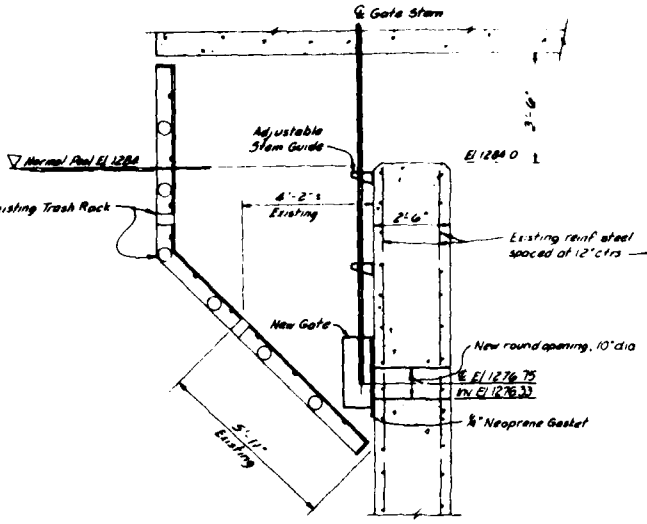


EXISTING INTAKE STRUCTURE

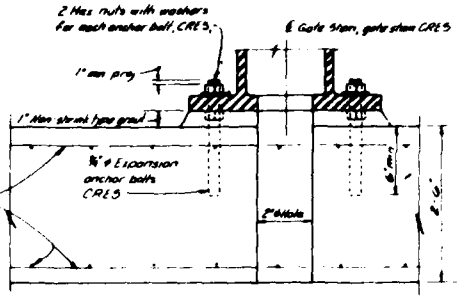
SCALE ½ INCH = 1 FOOT



ELEVATION

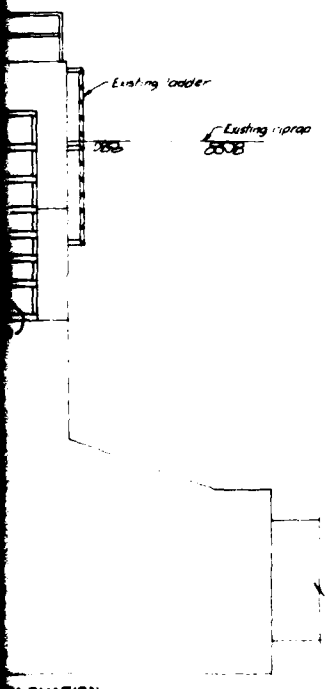


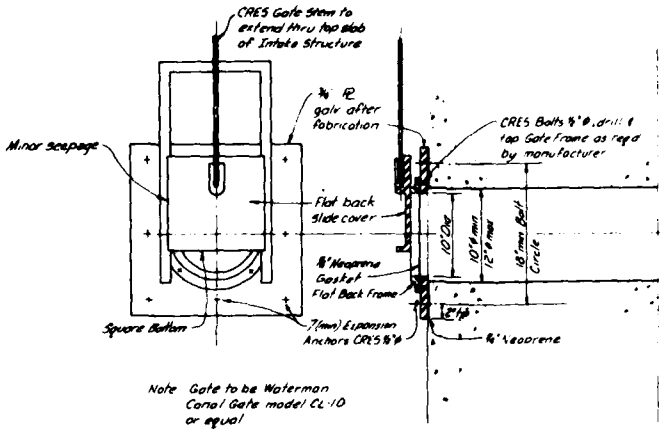
SECTION (1)



HOIST DETAIL
NO SCALE

NEW GATE DETAIL
SCALE ½ INCH = 1 FOOT





LOW FLOW SLIDE GATE

Notes
1 Contractor shall verify that existing trash rack can be replaced if removed and does not interfere with new gate
2 CRES - Corrosion Resisting Steel

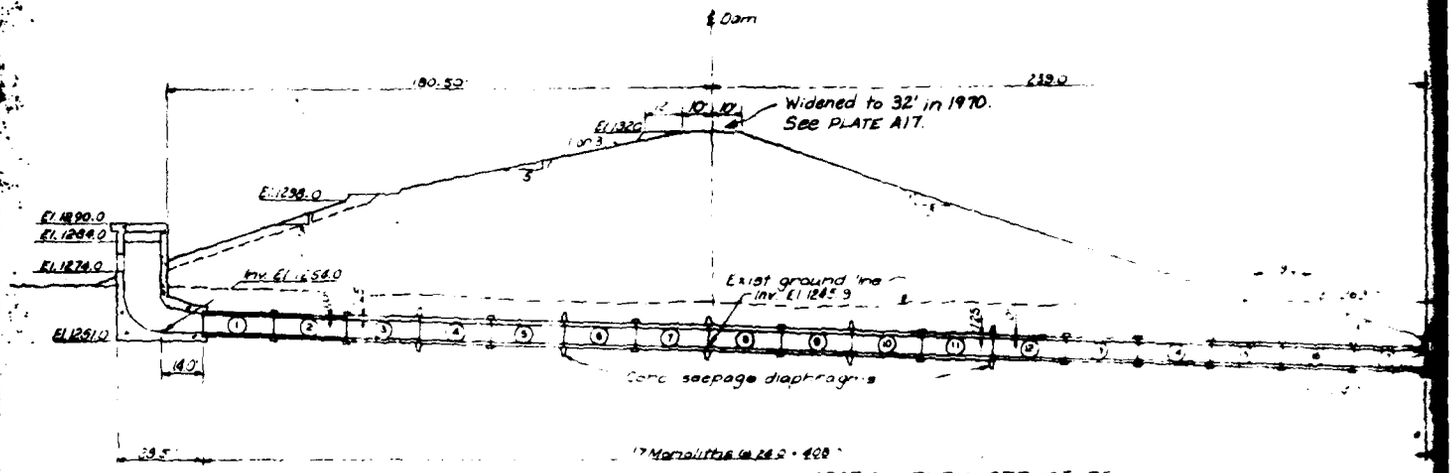
THIS DRAWING WAS ORIGINALLY REDUCED TO THREE-EIGHTHS THE ORIGINAL SCALE

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

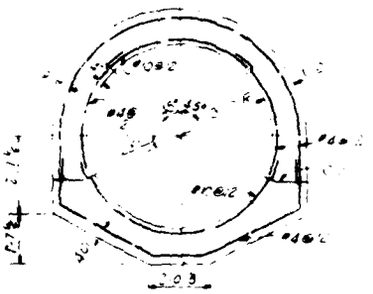
SALT CREEK AND ITS TRIBUTARIES, NEBRASKA
BRANCHED OAK DAM AND LAKE
SITE NO. 18
WATER RIGHTS GATE
DETAILS

MAY 1981

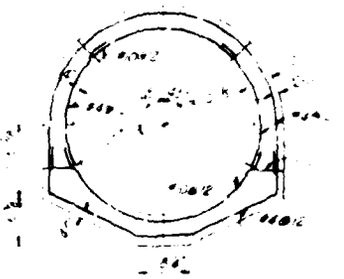
MSC30-61E2



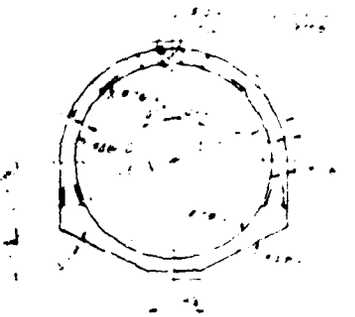
SECTION THRU STRUCTURE



MONOLITHS 3 THRU 11



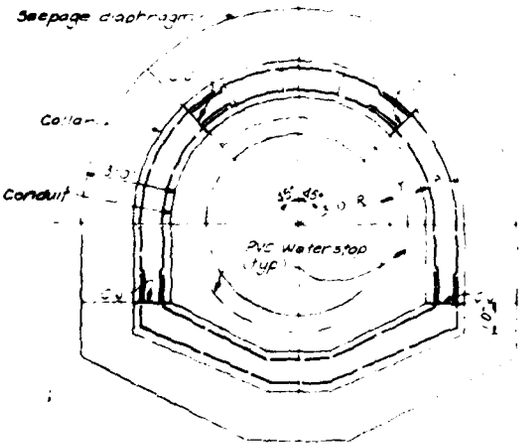
MONOLITHS 4,2,12 & 13



MONOLITHS 14 THRU 17

SECTIONS THRU CONDUIT

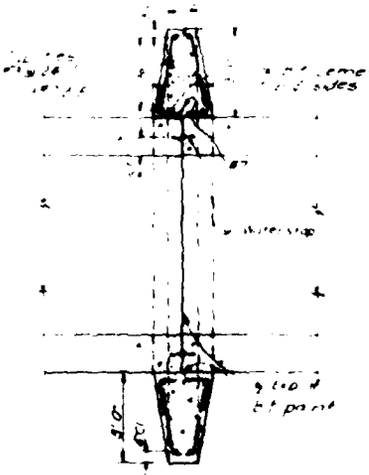
SCALE 1 INCH = 1 FOOT



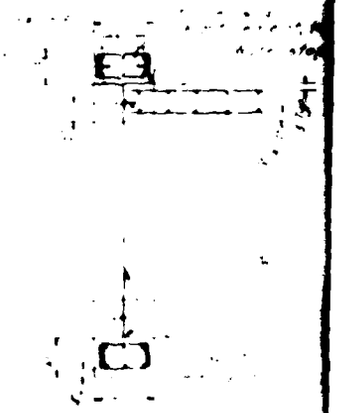
SECTION

SHOWING COLLAR & REINF
WATERSTOP AND SEEPAGE
DIAPHRAGM LIMITS

SCALE 1 INCH = 1 FOOT



MONOLITH JOINT AND
CONCRETE SEEPAGE DIAPHRAGM
DETAIL

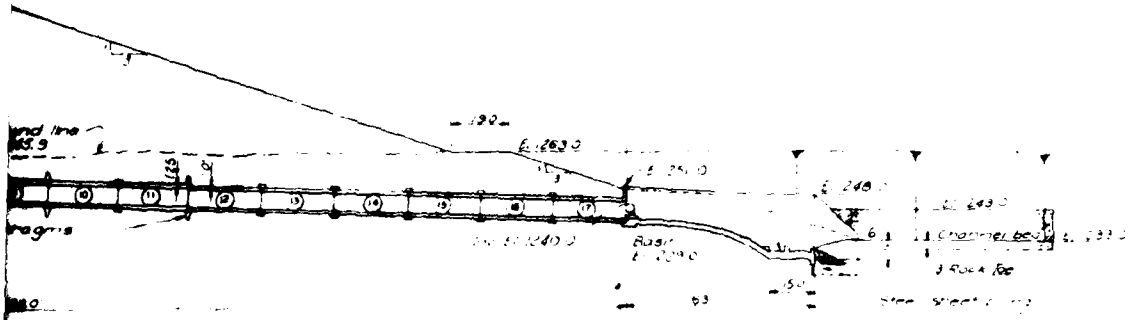


MONOLITH JOINT &
COLLAR DETAIL

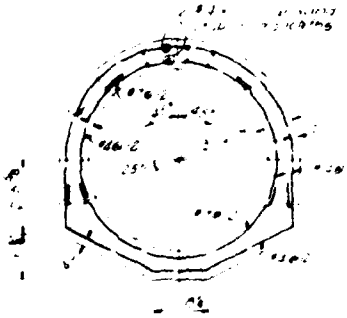
SCALE 1 INCH = 1 FOOT

EMBA

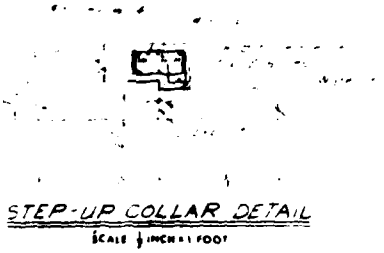
ined to 32' in 1970.
PLATE A17.



ECTION THRU STRUCTURE

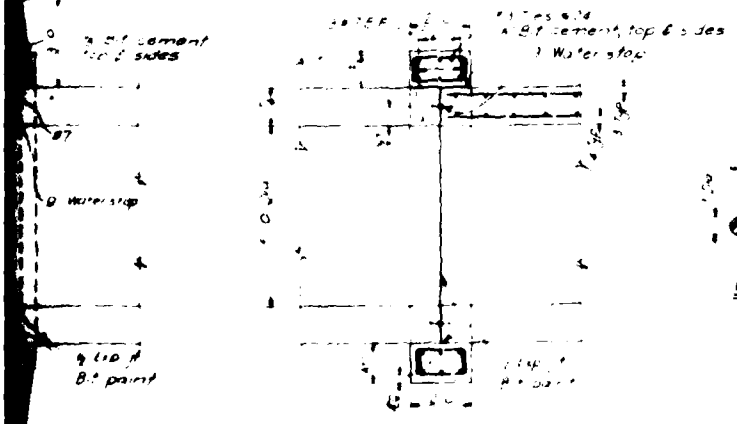


MONOLITHS 14 THRU 17

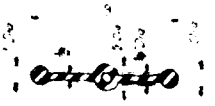


STEP-UP COLLAR DETAIL
SCALE ½ INCH = 1 FOOT

GENERAL NOTES:
1. Clear distance of reinforcement from concrete surfaces shall be 4".
2. Reinforcement is not continuous through monolith joints.



MONOLITH JOINT & COLLAR DETAIL
SCALE ½ INCH = 1 FOOT

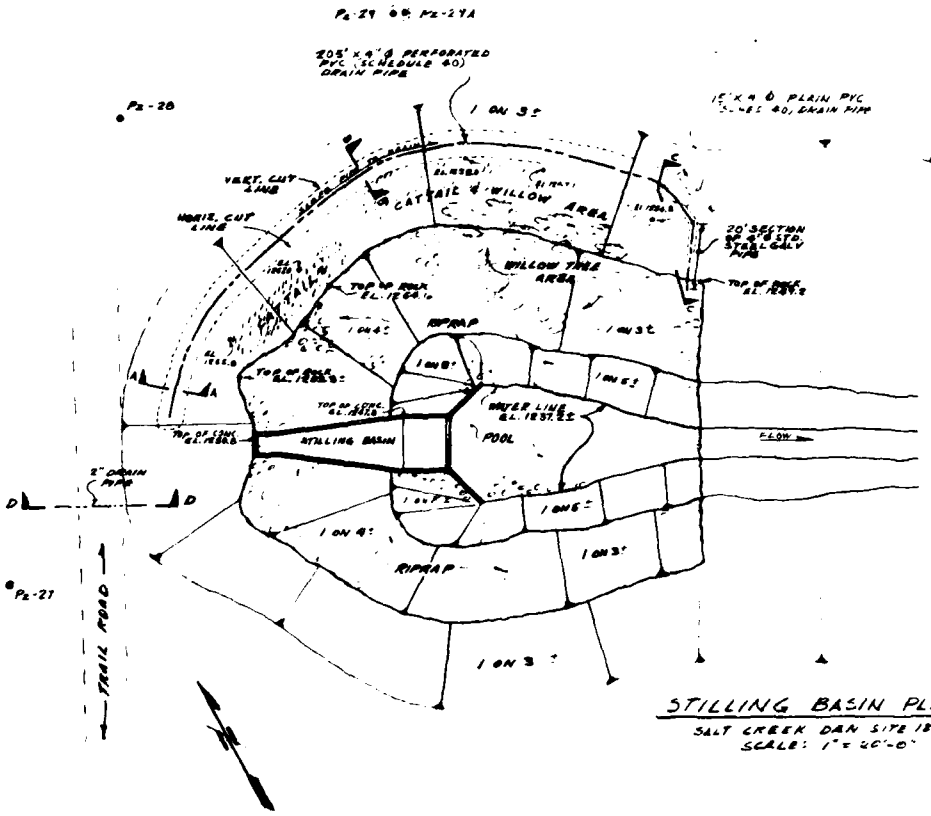


WATERSTOP DETAIL
SCALE 3 INCHES = 1 FOOT

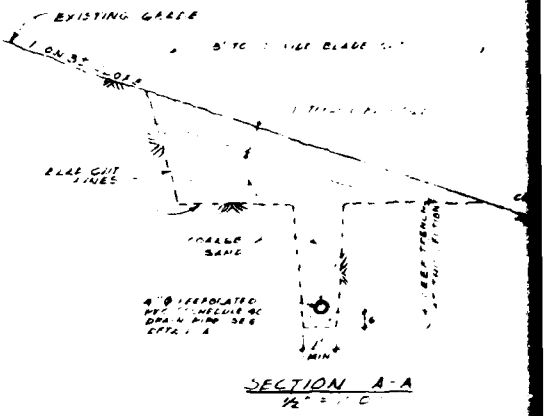
U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

BRANCHED OAK DAM AND LAKE
SITE NO 18
OUTLET WORKS
CONDUIT - CONC AND REINF DETAILS

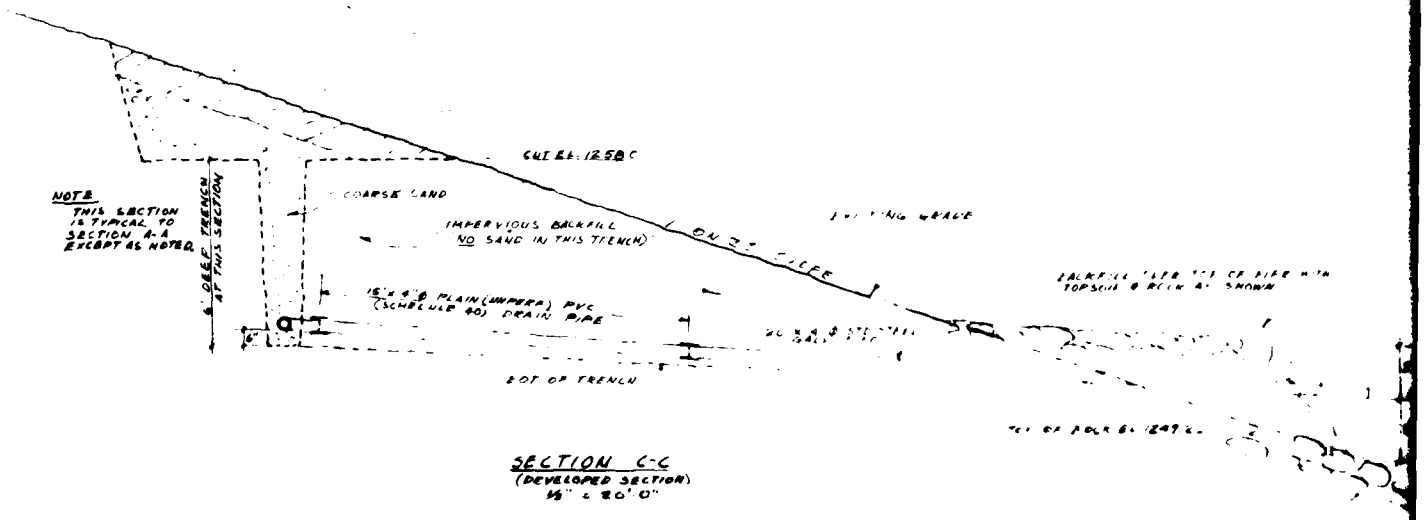
MSC13-311(E)



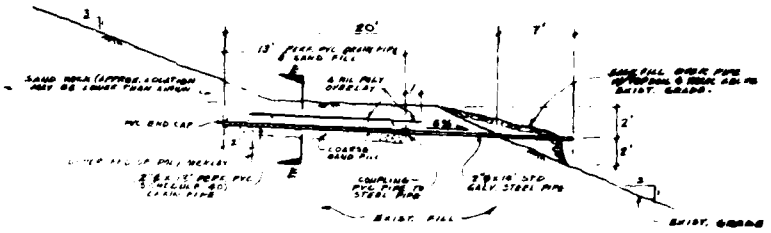
STILLING BASIN PLAN
SALT CREEK DAM SITE 18
SCALE: 1" = 20'-0"



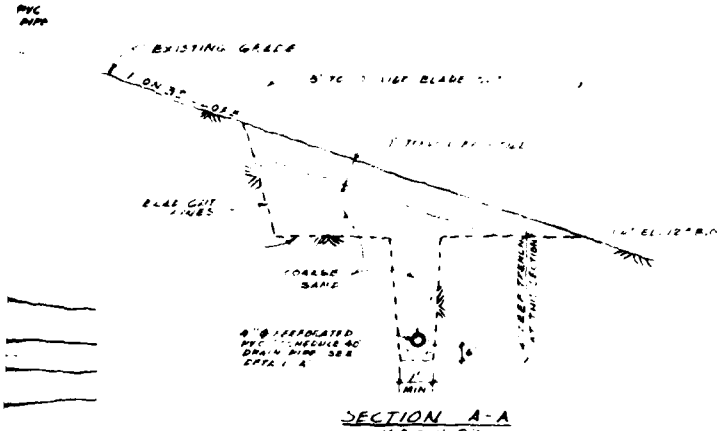
SECTION A-A
1/2" = 1'-0"



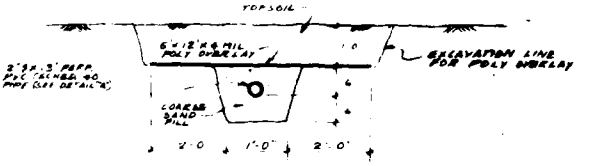
SECTION C-C
(DEVELOPED SECTION)
1/2" = 20'-0"



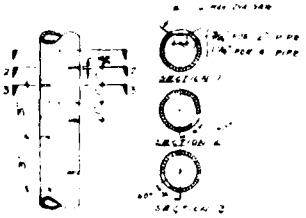
SECTION D-D
NO SCALE



SECTION A-A
1/2" = 1'-0"

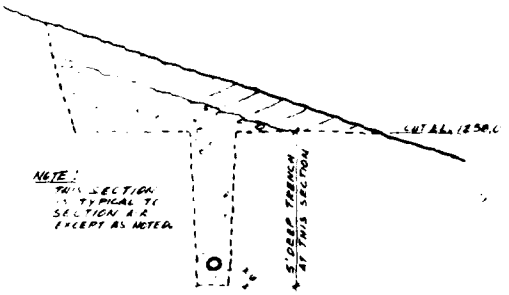


SECTION E-E
NO SCALE

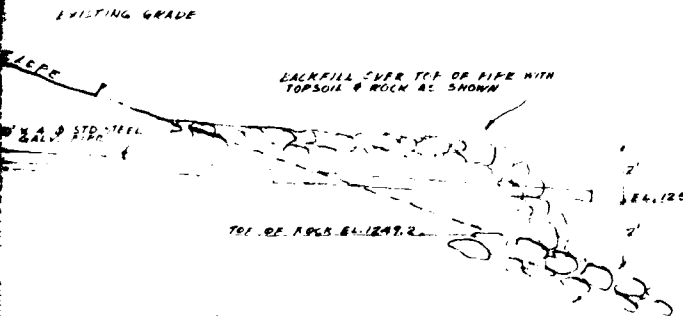


DETAIL A
NO SCALE
SLOT ARRANGEMENT FOR PERFORATED C.M.P. PIPE

BASIN PLAN
DAM SITE 18
1" = 20'-0"



SECTION B-B
1" = 20'-0"



DATE	DESCRIPTION	CHKD	APPVD
	REVISIONS		

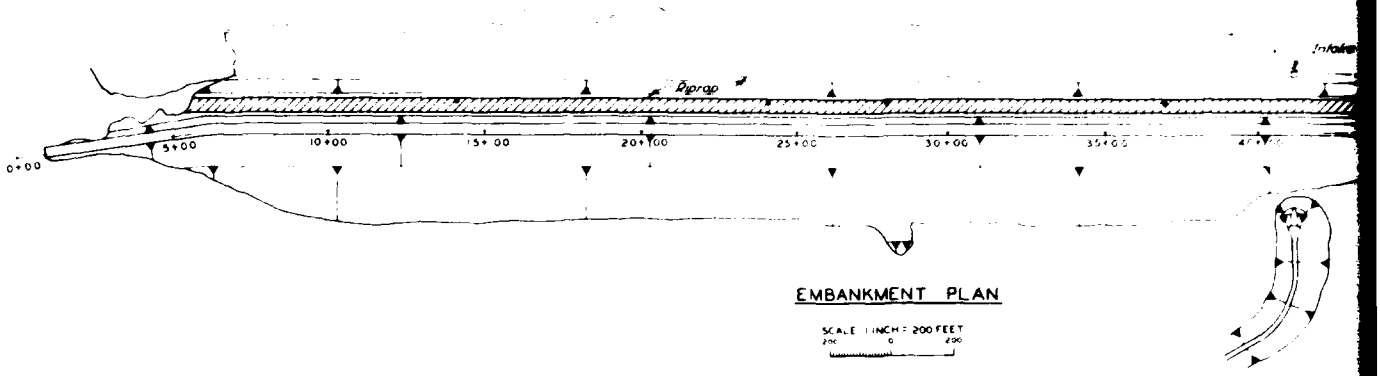
U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

SALT CREEK AND ITS TRIBUTARIES, NEBR
SITE 18
BRANCHED OAK DAM
STILLING BASIN DETAILS

DESIGNED BY
DRAWN BY
CHECKED BY
SUBMITTED BY
DATE
APPROVED
RECOMMENDED
APPROVED
DATE
SCALE AS SHOWN
DWG. NO.

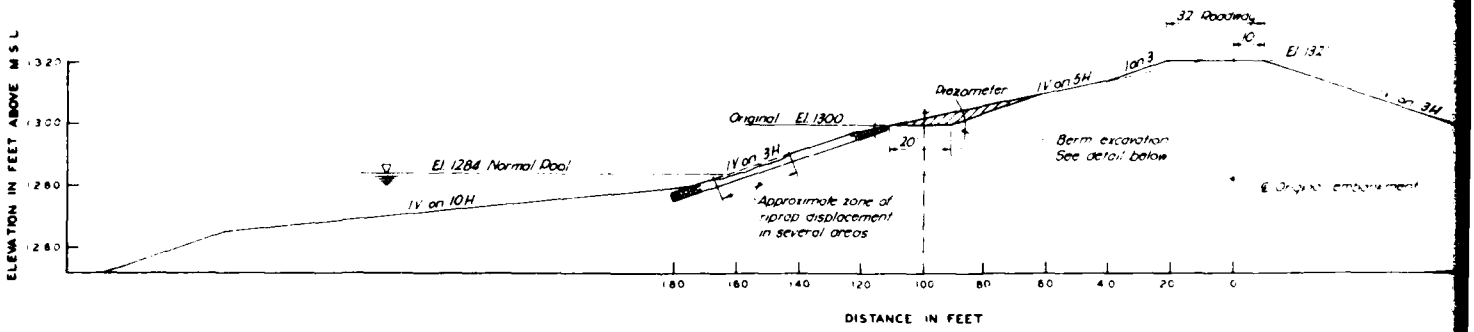
THIS PLAN ACCOMPANIES CONTRACT NO.
MODIFICATION NO.

SAFETY PAYS



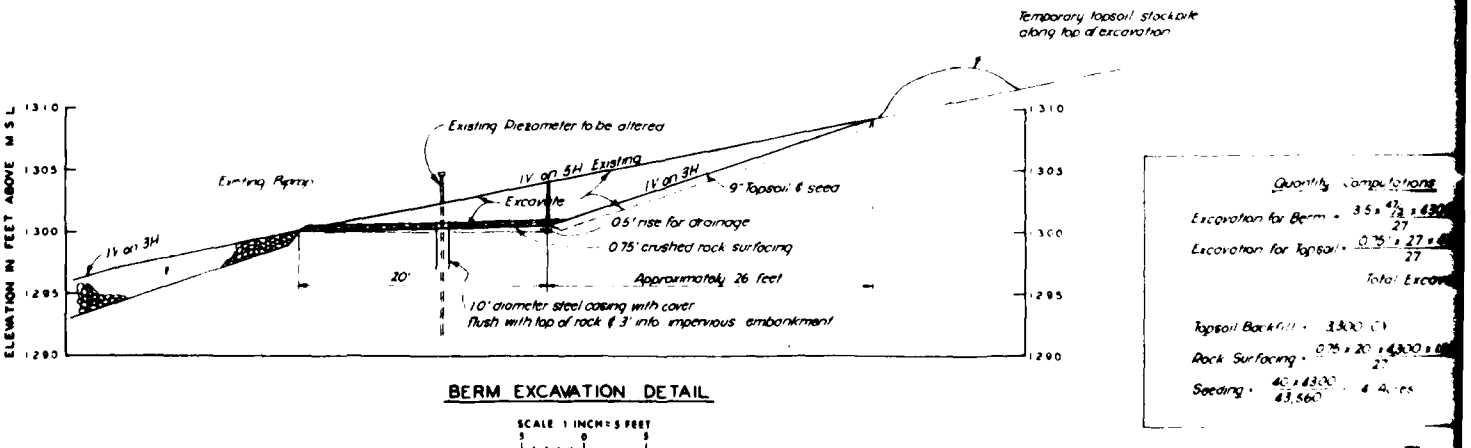
EMBANKMENT PLAN

SCALE 1 INCH = 200 FEET



TYPICAL SECTION

SCALE 1 INCH = 20 FEET



BERM EXCAVATION DETAIL

SCALE 1 INCH = 5 FEET

Quantity computations

Excavation for Berm = $35 \times \frac{47}{2} \times \frac{4300}{27}$

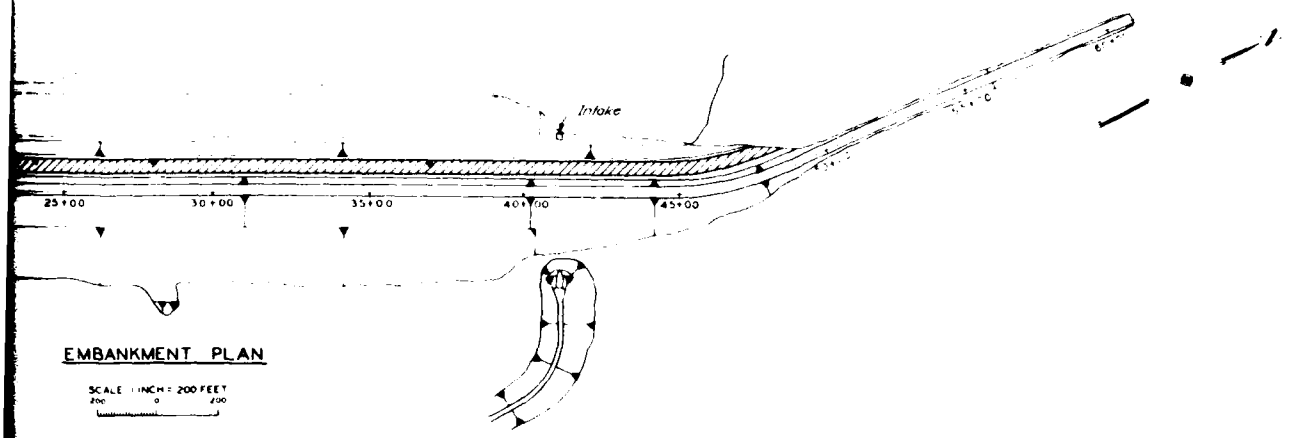
Excavation for Topsoil = $\frac{0.75 \times 27 \times}{27}$

Total Excav

Topsoil Backfill = 3,300 CY

Rock Surfacing = $\frac{0.75 \times 20 \times 4,300 \times}{27}$

Seeding = $\frac{40 \times 43,00}{43,560}$ = 4 Acres



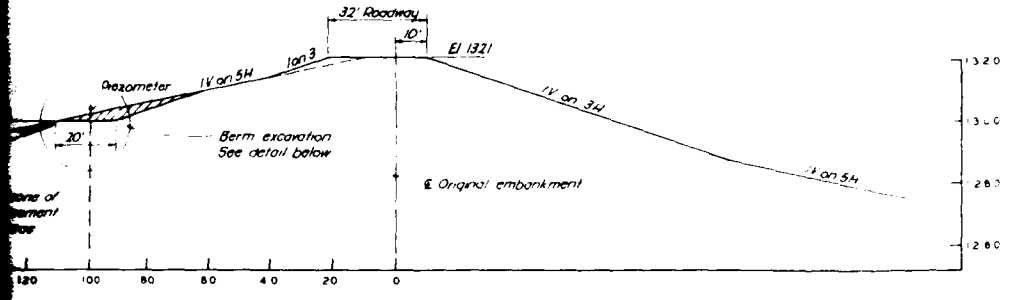
EMBANKMENT PLAN

SCALE 1 INCH = 200 FEET
200 0 200

LEGEND:

Area of Excavation for Berm Construction

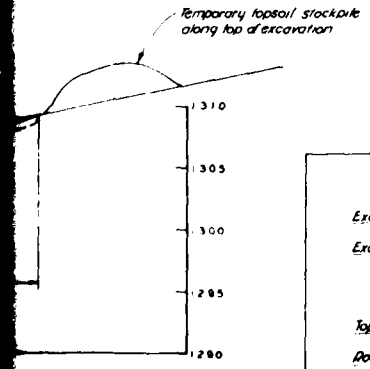
Piezometer to be Altered



DISTANCE IN FEET

TYPICAL SECTION

SCALE 1 INCH = 20 FEET
20 0 20



Quantity Computations

Excavation for Berm = $\frac{3.5 \times 47\frac{1}{2} \times 4300'}{27}$ = 13,100 CY

Excavation for Topsoil = $\frac{0.75' \times 27 \times 4300'}{27}$ = 3,300 CY

Total Excavation = 16,400 CY

Topsoil Backfill = 3,300 CY

Rock Surfacing = $\frac{0.75 \times 20' \times 4300' \times 165}{27}$ = 3,975 Tons

Seeding = $\frac{40 \times 4300}{43,560}$ = 4 Acres

SAFETY DAYS

DATE	DESCRIPTION	MADE	APPR'D
	REVISIONS		

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

DESIGNED BY
DRAWN BY
CHECKED BY
SUBMITTED BY
CHIEF, LMD & S.S. SECTION
SUPERVISOR
CHIEF, E & M. BRANCH
APPROVED

SALT CREEK
BRANCHED OAK DAM AND RESERVOIR
EMBANKMENT BERM
PLAN AND SECTION

APPROVED — DATE
CHIEF, ENGINEERING DIVISION
SCALE AS SHOWN | SPEC. NO. DACA43
DRAWING NUMBER
CHIEF, L. & S. SURVEY BRANCH — SHEET

THIS PLAN ACCOMPANIES CONTRACT No. DACA43 MODIFICATION No

APPENDIX B
PHOTOGRAPHS

PHOTO NO. 1 - October 1973, aerial view of project. Pool elevation is 1286.6, approximately 2.6' above normal operating pool. Note: This is the highest pool elevation ever recorded at Branched Oak Dam.

PHOTO NO. 2 - October 1973, aerial view of project. High pool condition.

PHOTO NO. 1 - October 1973, aerial view of project. Pool elevation is 1286.6, approximately 2.6' above normal operating pool. Note: This is the highest pool elevation ever recorded at Branched Oak Dam.

PHOTO NO. 2 - October 1973, aerial view of project. High pool condition.

PHOTO NO. 3 - October 1973, aerial view of project. High pool condition. Note: Emergency spillway is shown in the lower right hand side of the photo.

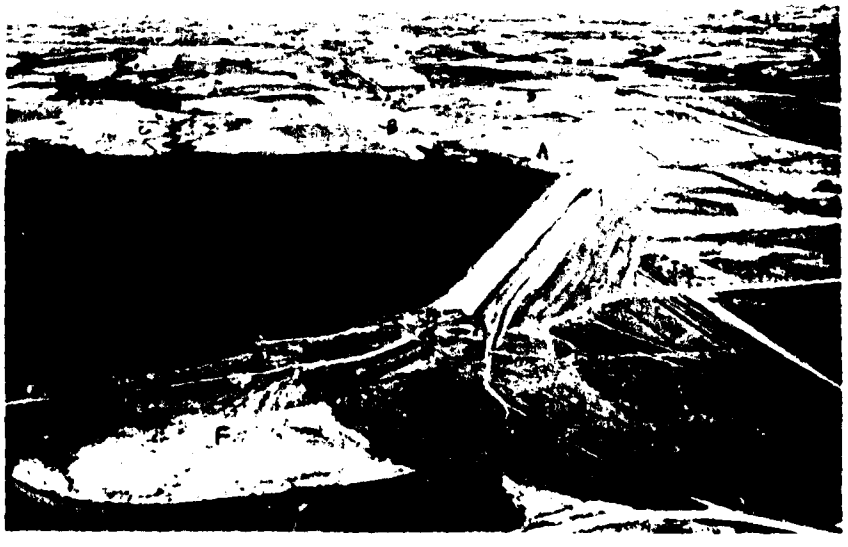


PHOTO NO. 4 - August 1968, aerial view of project during ponding of the reservoir. Note: Letters indicate Borrow Areas A, B, C and F and the Emergency Spillway(S).

PHOTO NO. 5 - View of upstream embankment slope, crushed rock surfaced service road, and upstream slope riprap protection from the left abutment. September 1982

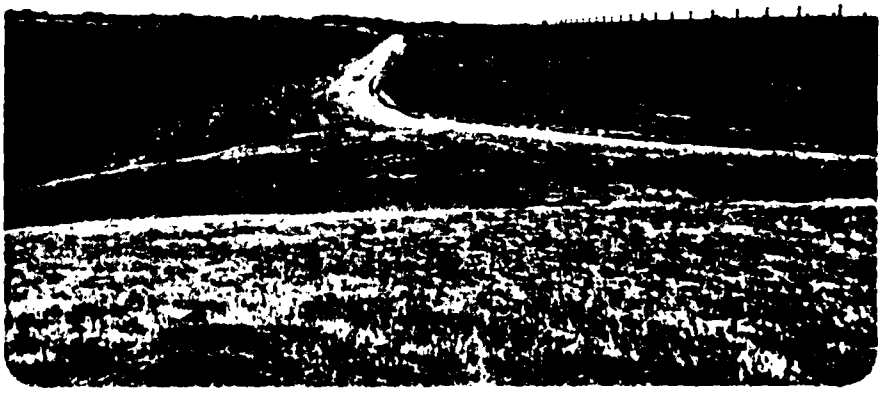


PHOTO NO. 6 - View of upstream embankment slope, crushed rock surfaced service road, and upstream slope riprap protection from the right abutment. September 1982

PHOTO NO. 7 - Overview of dam crest, downstream slope, and right abutment. September 1982

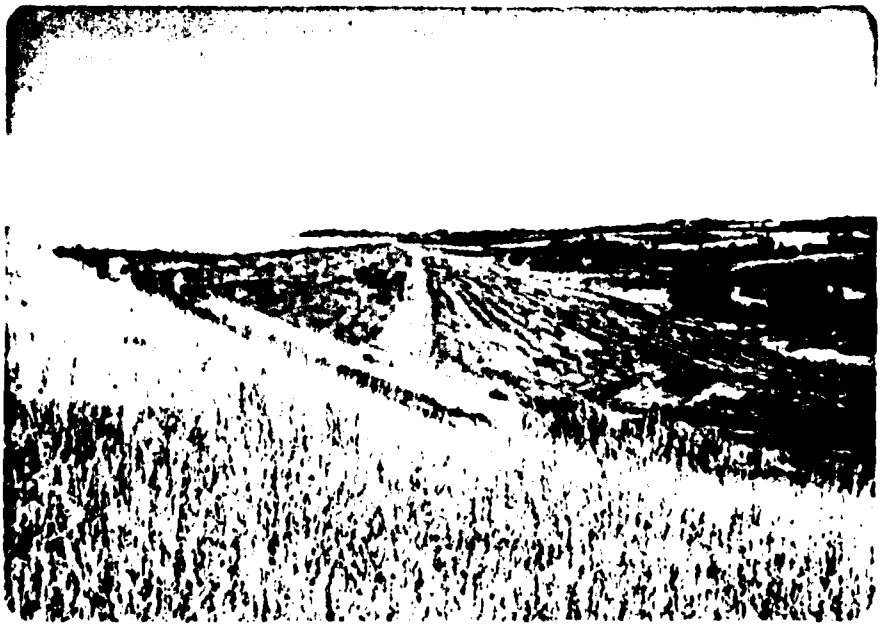


PHOTO NO. 8 - View of downstream slope of the dam from the right abutment. September 1982

PHOTO NO. 9 - View of upstream embankment slope, crushed rock surfaced service road, riprap slope protection and outlet works intake tower, from the left abutment. September 1982

PHOTO NO. 10 - View of riprap slope protection on the IV on 3H upstream embankment slope. September 1982

PHOTO NO. 11 - View of riprap slope protection on right abutment shoreline area. September 1982

PHOTO NO. 12 - View of upstream end of emergency spillway. Highway shown crosses dam to left. September 1982

PHOTO NO. 13 - View of emergency spillway channel looking downstream from near highway.
September 1982

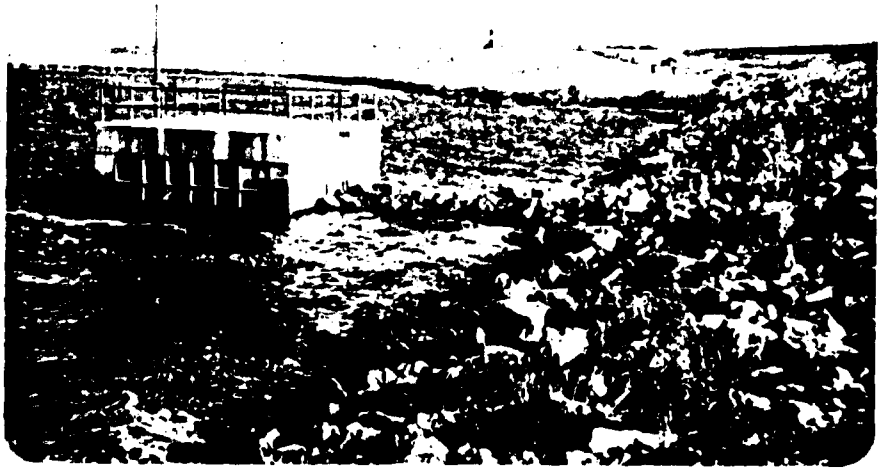


PHOTO NO. 14 - View of outlet works intake structure and riprap near north end of the embankment.
September 1982

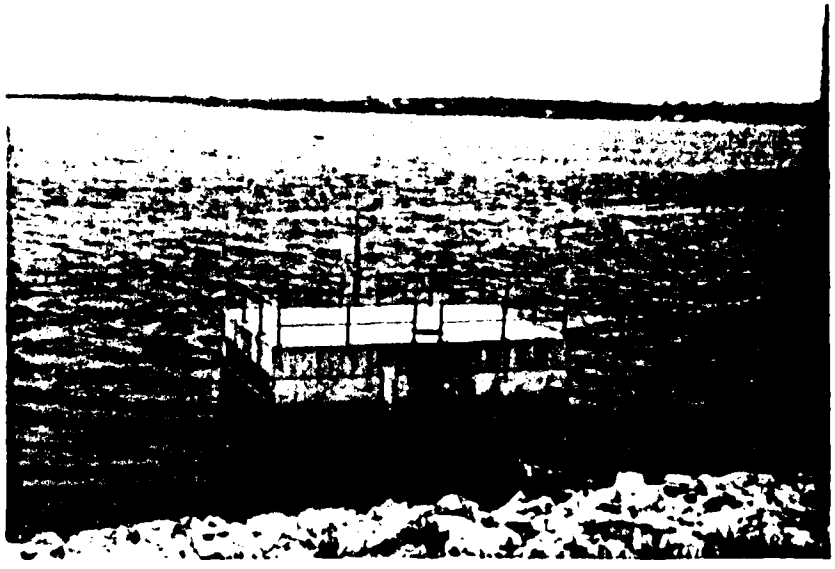


PHOTO NO. 15 - View of outlet works intake structure at conservation pool level. (1284.0' m. s. l.) May 1974

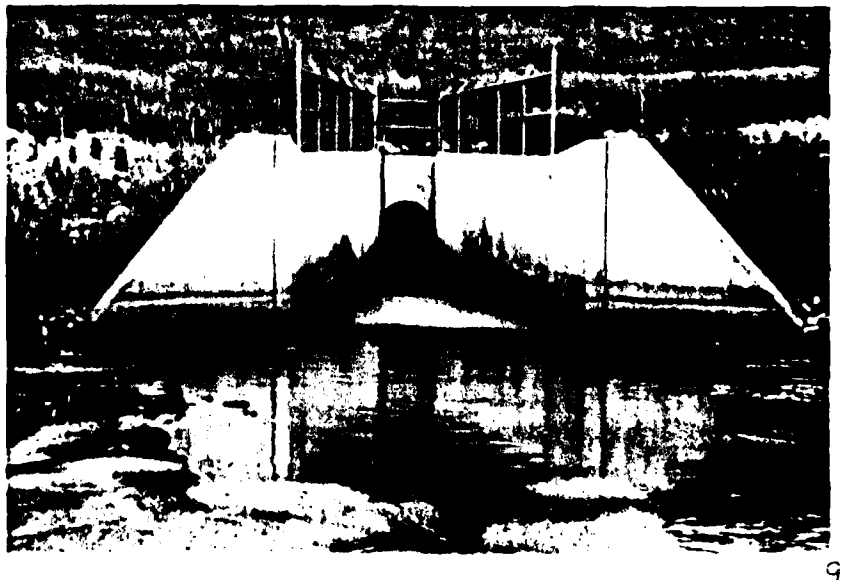


PHOTO NO. 16 - View of stilling basin structure and conduit portal. June 1974

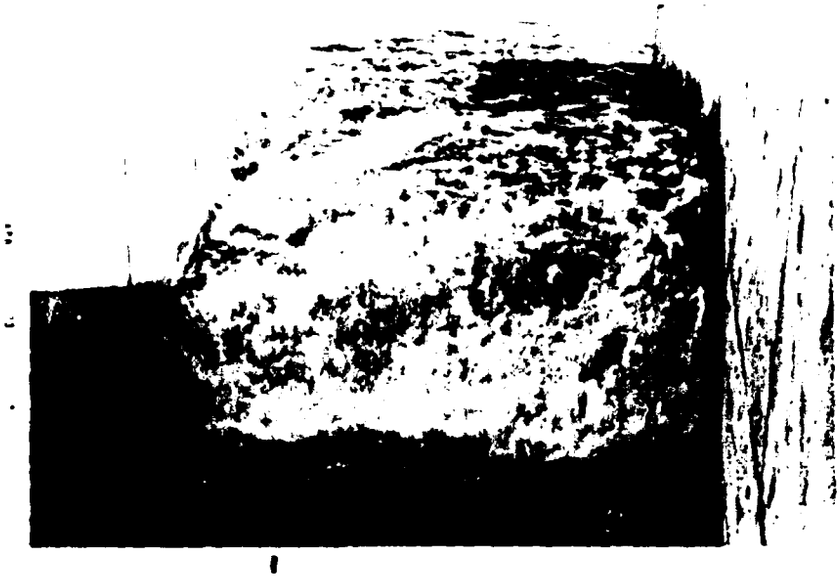


PHOTO NO. 17 - View of hydraulic jump created in stilling basin. The jump dissipates the energy of the flowing water, and therefore reduces erosion in the downstream channel. April 1973

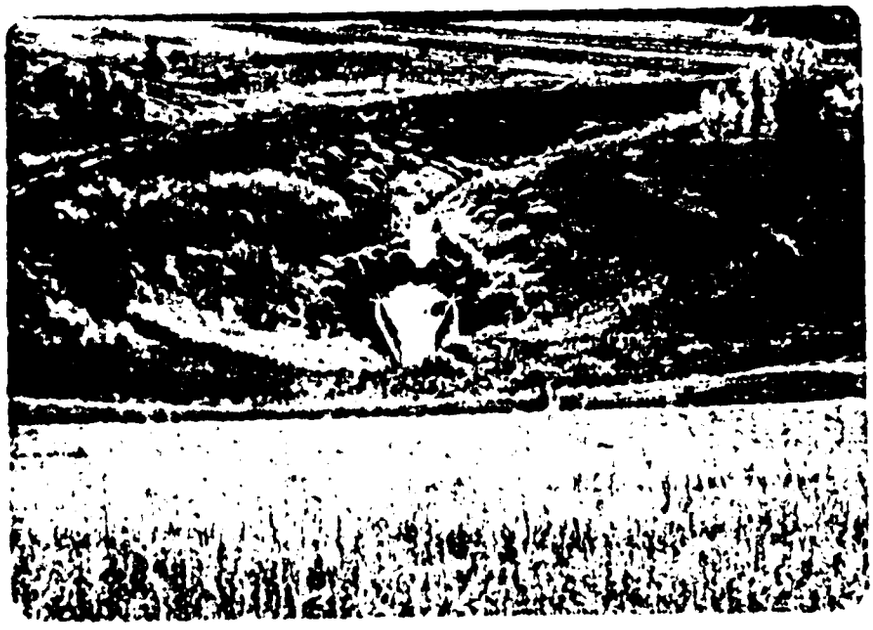


PHOTO NO. 18 - View of stilling basin and discharge channel. September 1982

PHOTO NO. 19 - View of outlet channel from crest of dam. September 1982

PHOTO NO. 20 - View of crushed rock surfaced service road during construction. November 1976

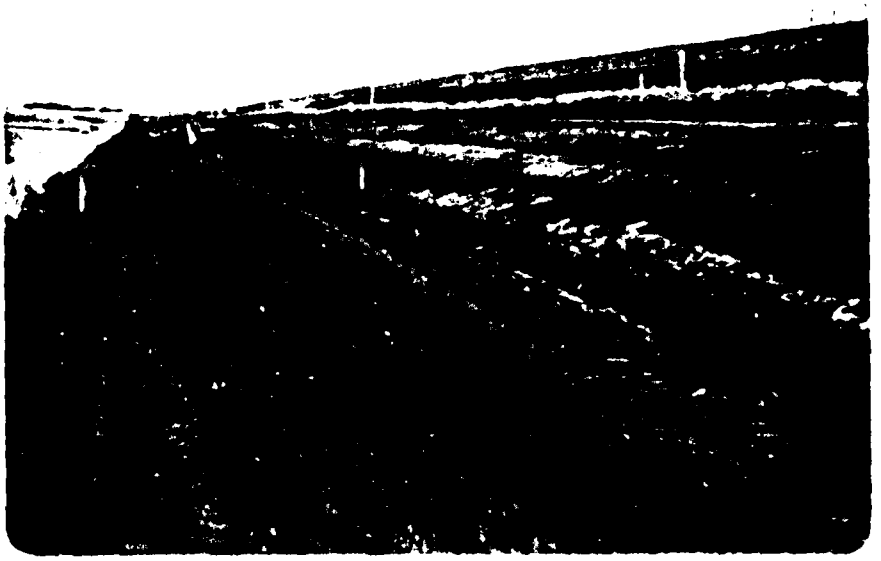


PHOTO NO. 21 - View of crushed rock surfaced service road during construction. November 1976

PHOTO NO. 22 - View of outlet end of downstream valley relief well (on right side - flap lid) and parallel drain pipe (to left w/screen). Relief well flow is about 17 gpm and drain flow is about 5 gpm. September 1982

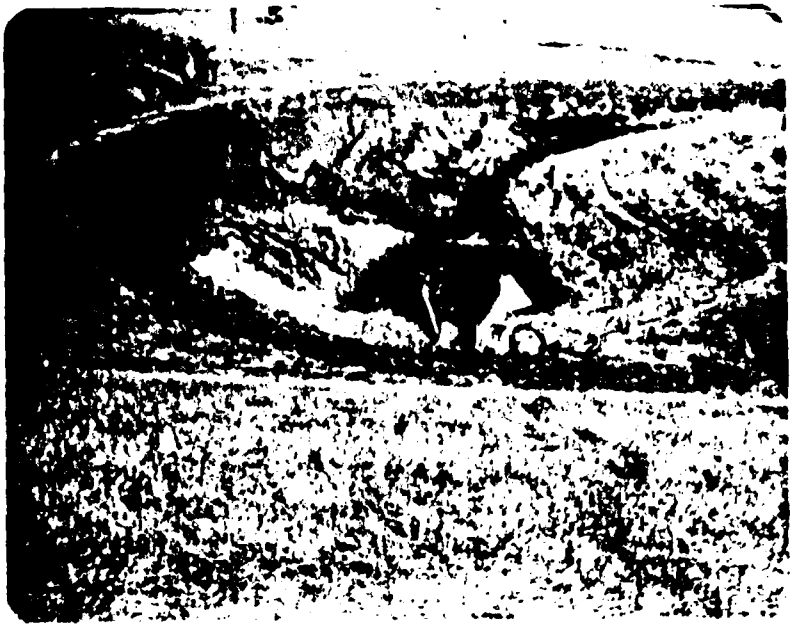


PHOTO NO. 23 - View of stilling basin from crest of dam. Arrow #1 points to 4" seepage drain (See Photo No. 25) and Arrow #2 points to a 2" seepage drain (See Photo No. 24). September 1982

PHOTO NO. 24 - View of 2" seepage drain which was installed in the outlet end of an embankment sand drain just upstream of the stilling basin structure. Flow is approx. 1.4 gpm. September 1982

PHOTO NO. 25 - View of 4" seepage drain installed along the left crest slope of the stilling basin. Flow is approx. 23.5 gpm. September 1982

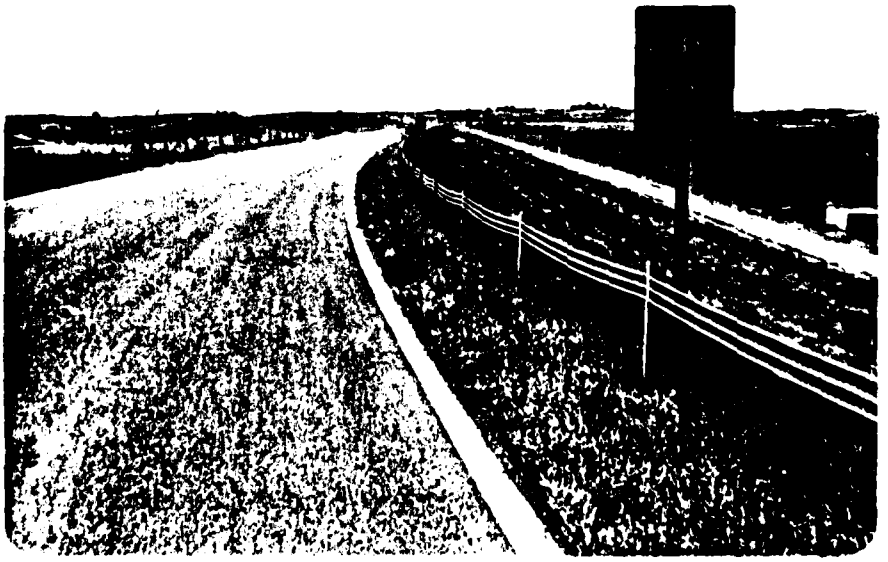
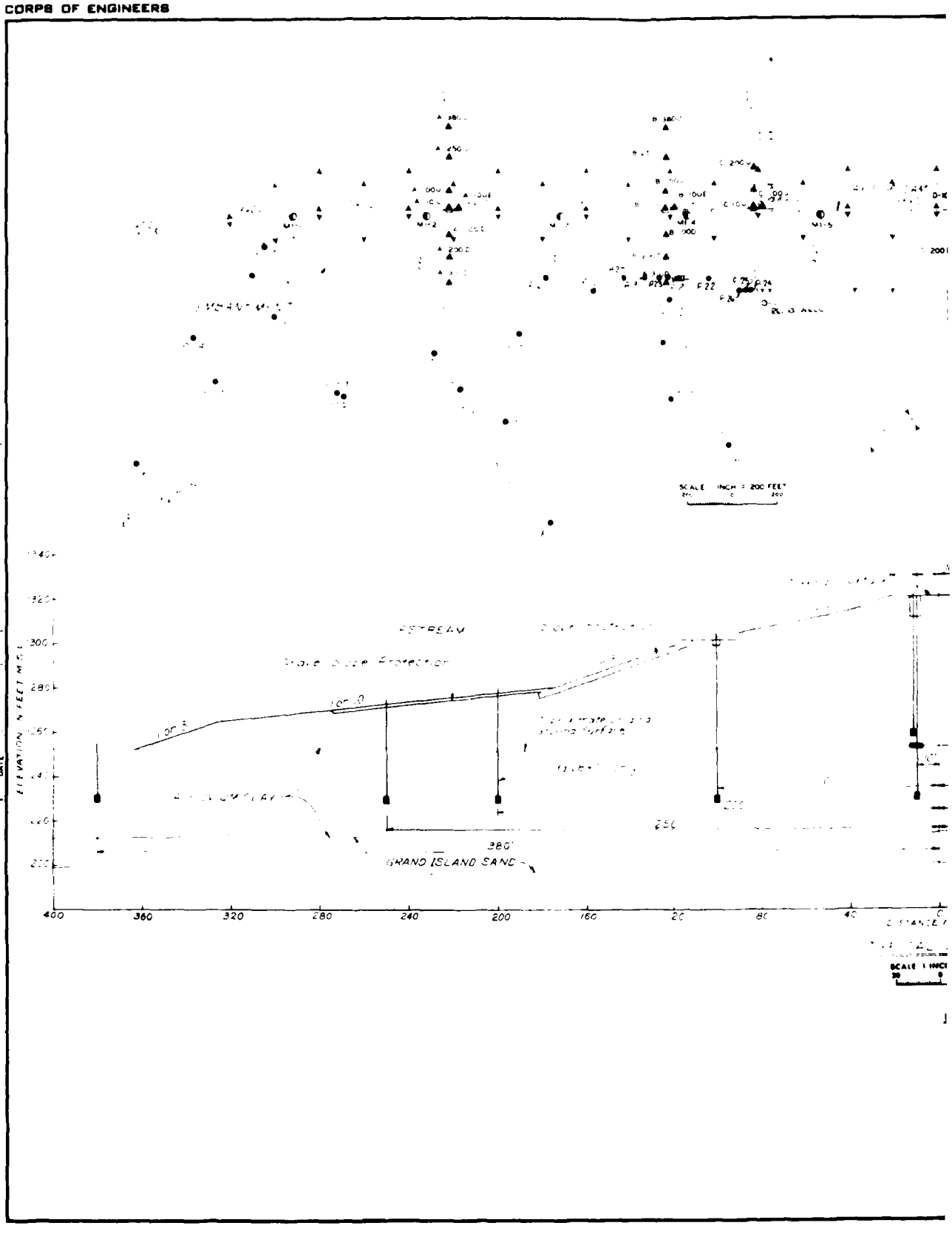


PHOTO NO. 26 - View of dam crest and paved highway which runs along the crest of the dam. Photo was taken from the upstream side of the embankment near the left abutment. September 1982

PHOTO NO. 27 - View of dam crest and paved highway which runs along the crest of the dam. Photo was taken from near the right abutment of the dam. September 1982

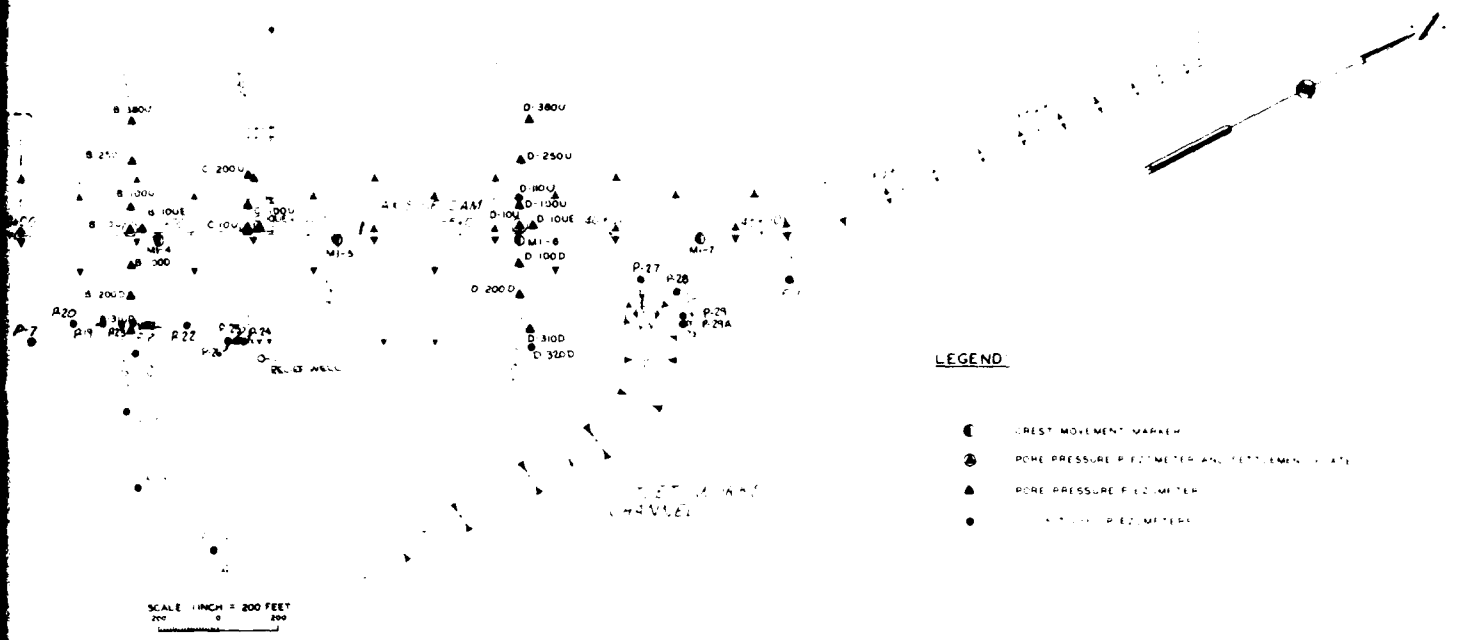
APPENDIX C
INSTRUMENTATION

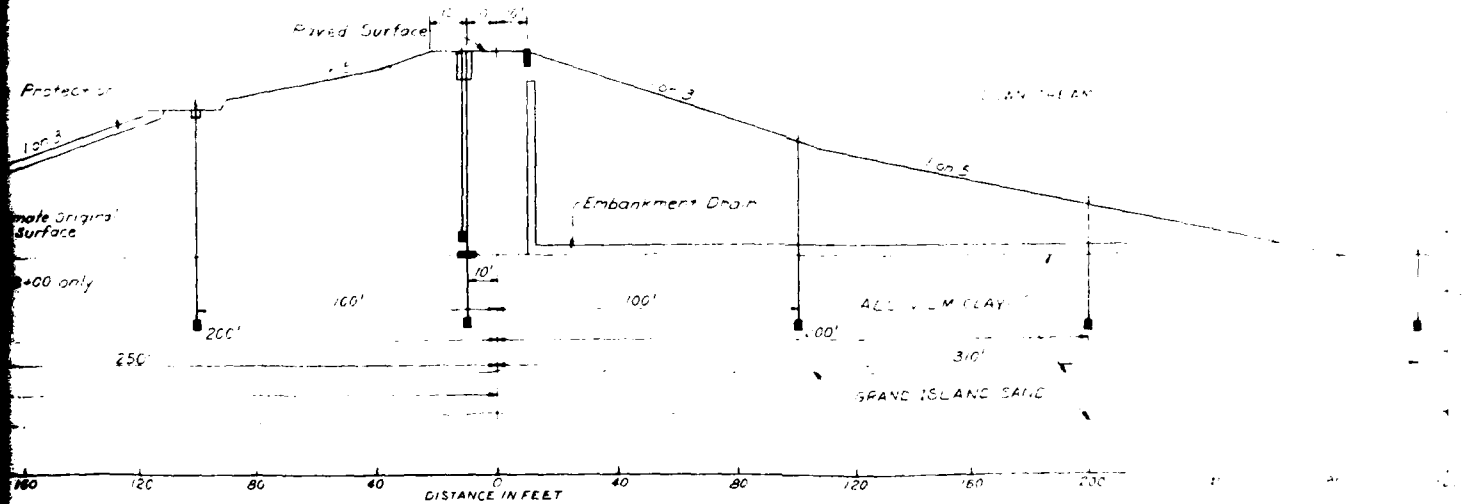
CORPS OF ENGINEERS



A 105 Mylar Film or A Paper Reproducible Record Copy Must Be Made Before Every Addendum and/or Modification

ADDENDUM NO
DATE
MODIFICATION
DATE





TYPICAL SECTION

SCALE: 1 INCH = 20 FEET
20 0 20

LEGEND:

- MOVEMENT POINTS
- PORE PRESSURE PIEZOMETER AND SETTLEMENT PLATE
- PORE PRESSURE PIEZOMETER

NOTE:
This plate supersedes Plate 7 Appendix "B" 1968 Inspection Report.

THIS DRAWING WAS REDUCED TO THREE-EIGHTHS THE ORIGINAL SCALE

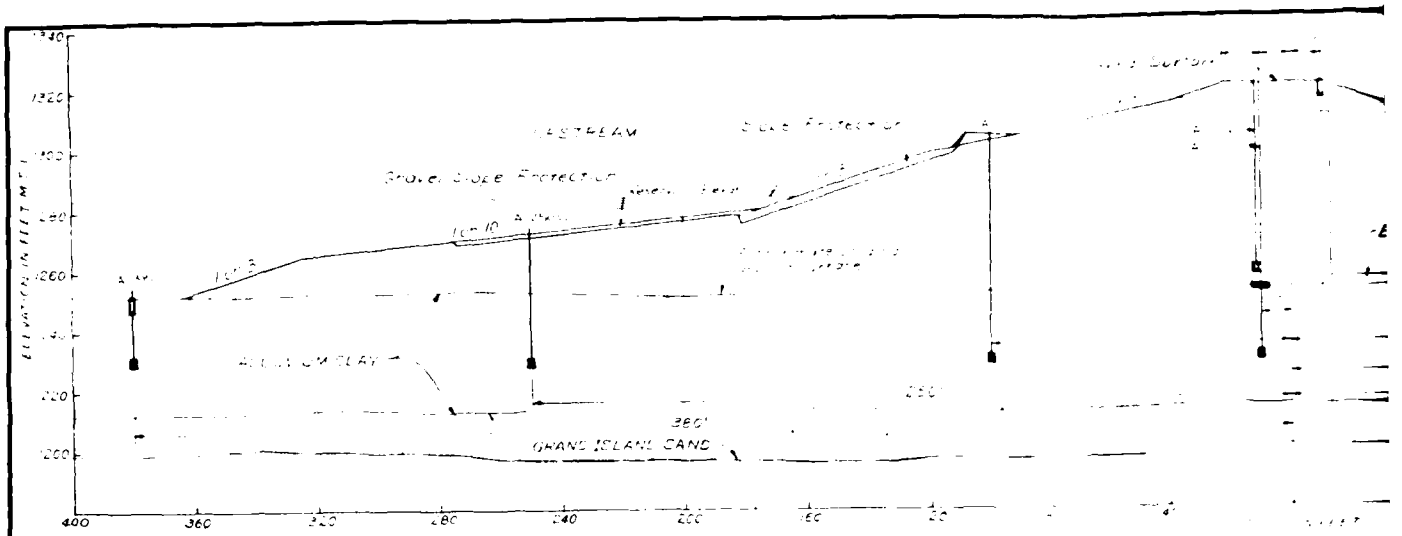
SAFETY PAYS

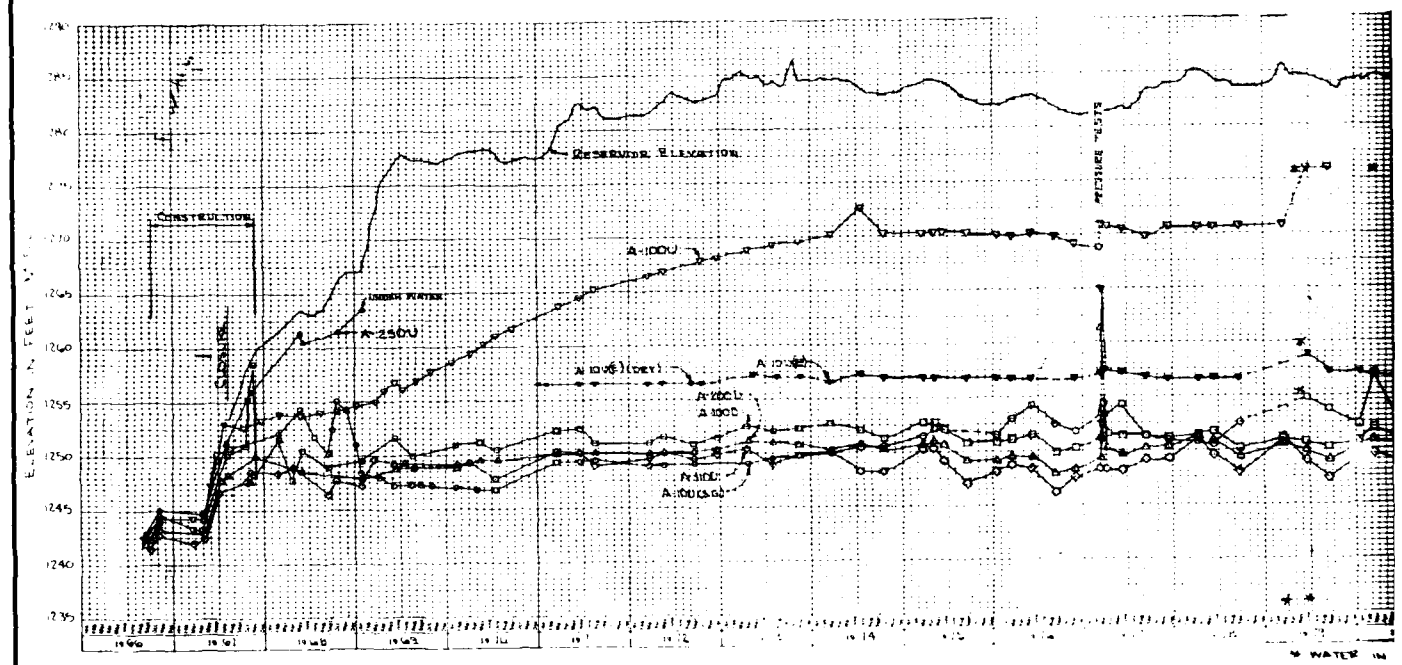
THIS PLAN ACCOMPANIES CONTRACT NO. MODIFICATION NO.

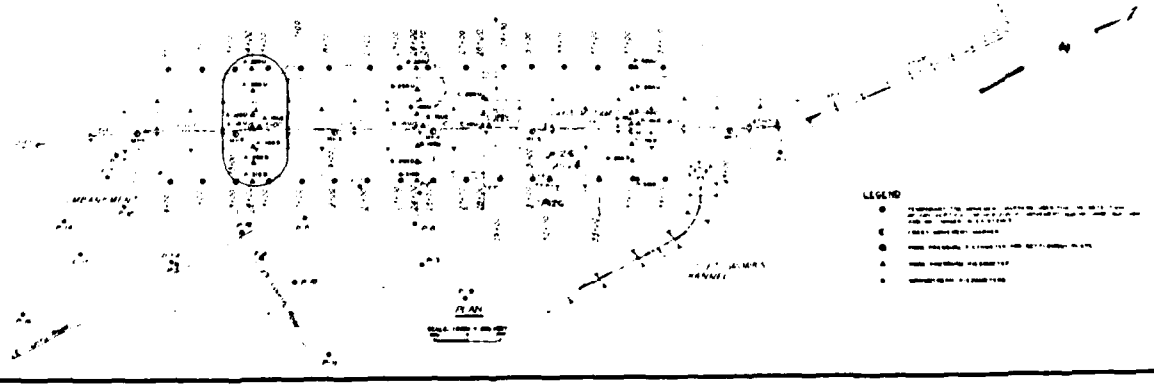
U. S. ARMY ENGINEER DISTRICT OMAHA
CORPS OF ENGINEERS
OMAHA NEBRASKA

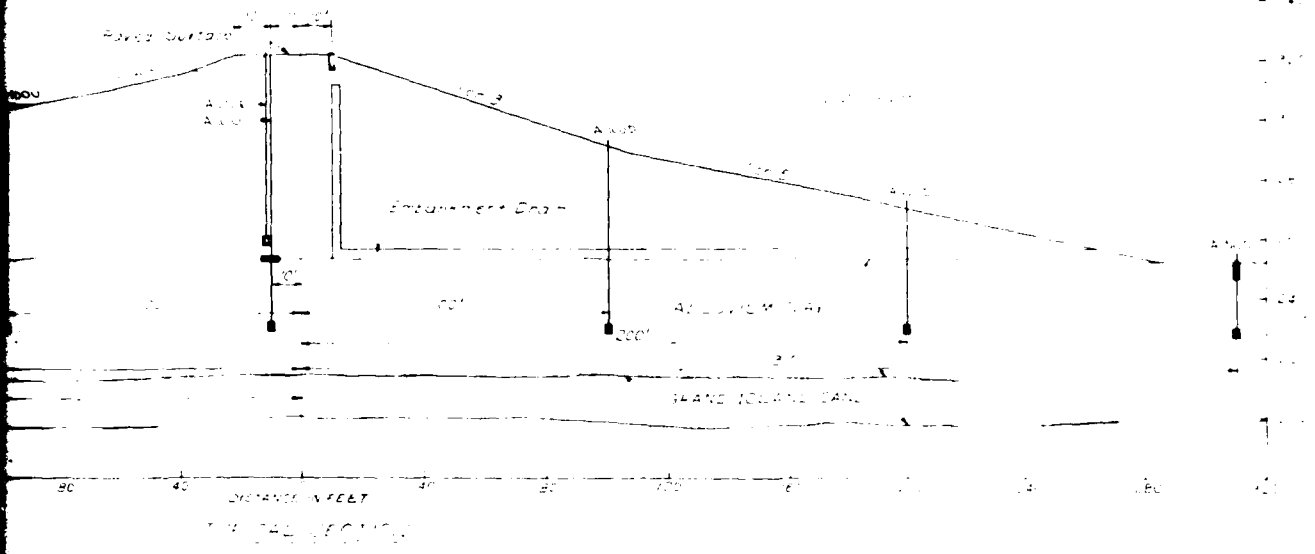
SALT CREEK AND ITS TRIBUTARIES, NEBRASKA
BRANCHED OAK DAM AND LAKE
SITE NO. 18
INSTRUMENTATION LOCATION PLAN

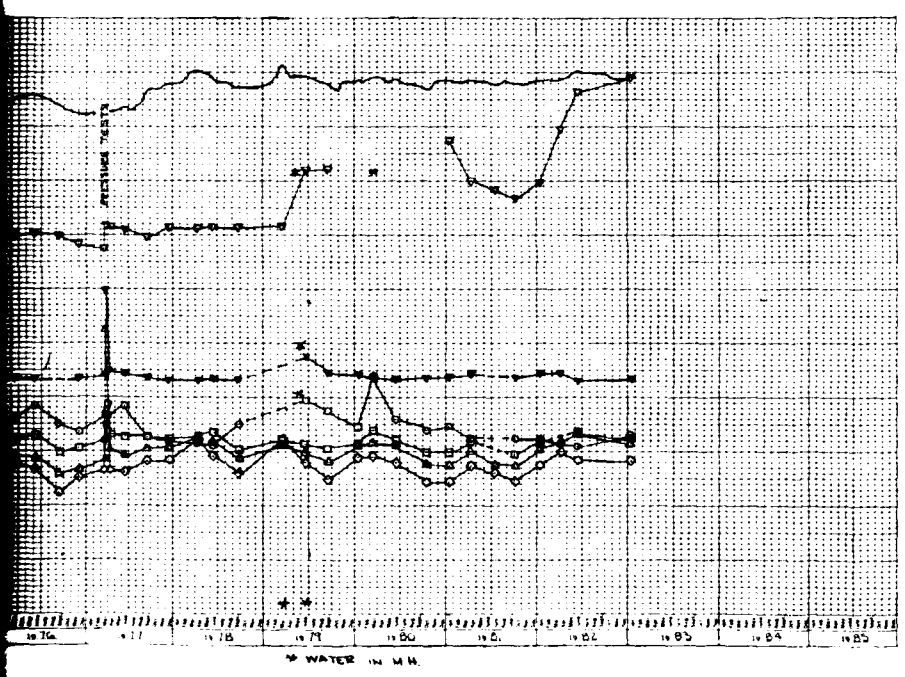
B P Sondergaard

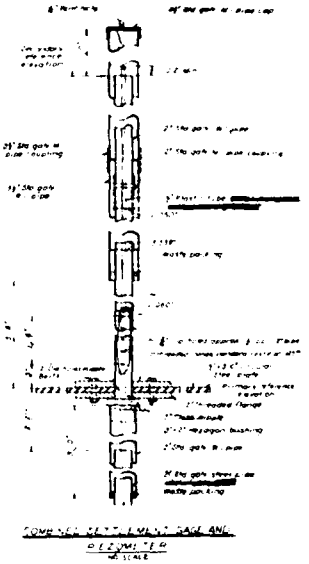

ELEVATION IN FEET M.S.L.
1320
1300
1280
1260
1240
1220
1200
GRAND ISLAND SAND
400
360
320
280
240
200
160
120


Reservoir Elevation
CONSTRUCTION
A-1000
A-2500
A-1000 (DRY)
A-1000 (S.G.)
ELEVATION IN FEET
1265
1260
1255
1250
1245
1240
1235


PLAN
LEGEND







SAFETY PAYS

THIS PLAN ACCOMPANIES CONTRACT NO.
MODIFICATION NO.

DATE	DESCRIPTION	MADE	APPR'D

REVISIONS

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

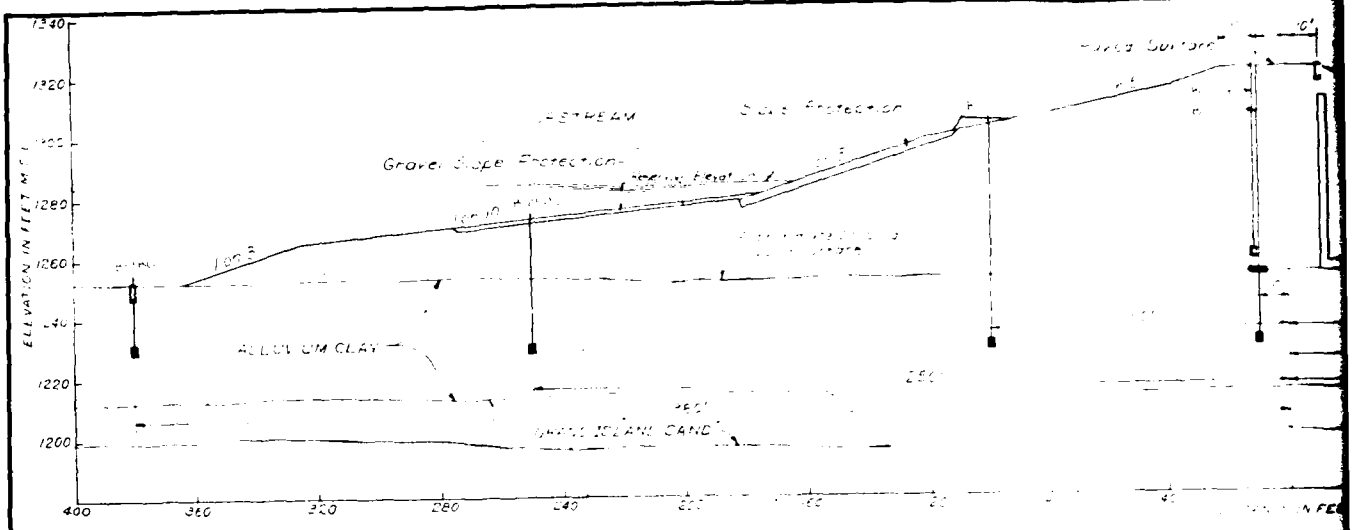
DESIGNED BY:
DRAWN BY:
CHECKED BY:
SUBMITTED BY:
UNIT SECTION
QUANTITIES:
UNIT DRAWING

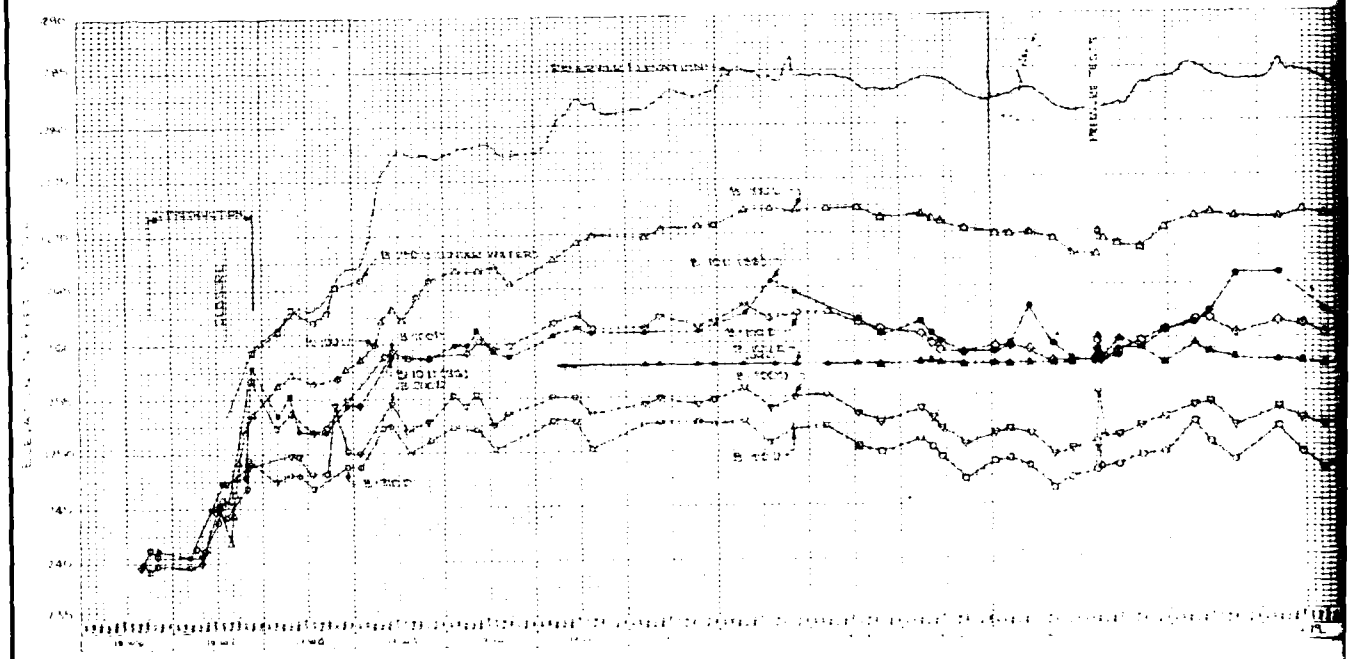
LAKE WEBB AND ITS TRIBUTARIES, NEBR.
SITE 1A
PRATT CREEK DAM
SLOPE PRESSURE PIEZOMETERS
LINE "A" STA. 14+00

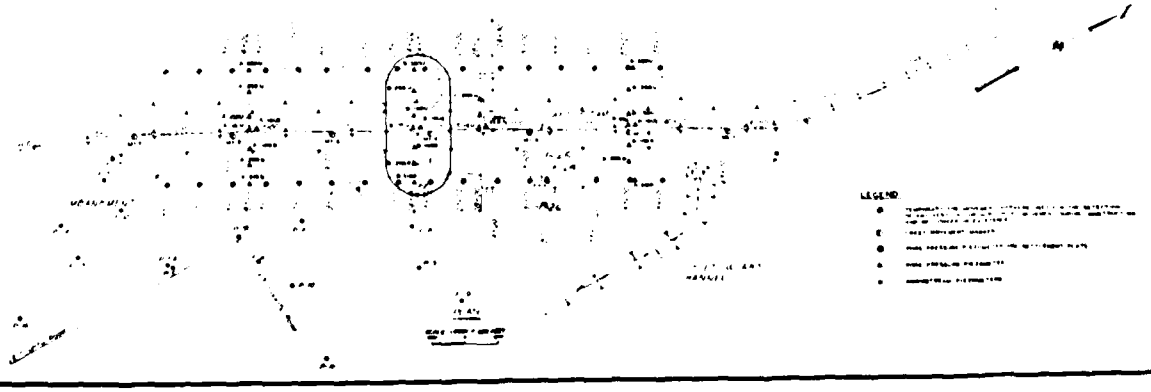
APPROVED DATE
CHIEF, ENGINEERING DIVISION

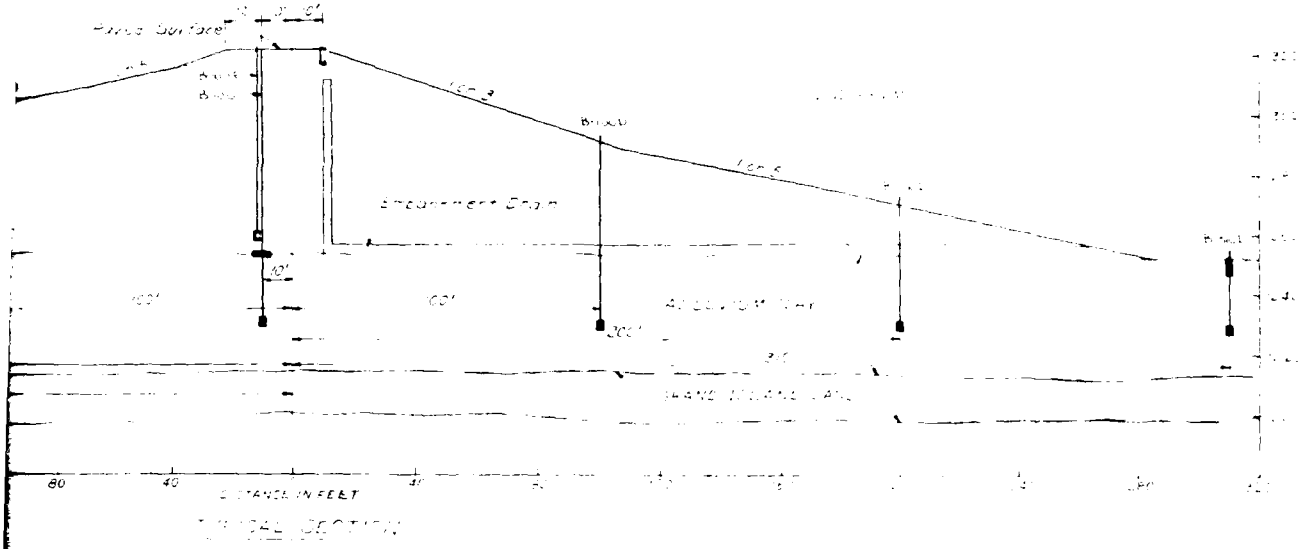
APPROVED SCALE AS SHOWN SPEC. NO.
DRAWING NUMBER
DIST. U. S. C. DISTRICT ENGINEER SHEET

EMBANKMENT CRITERIA AND PERFORMANCE REPORT (1983) PLATE C2

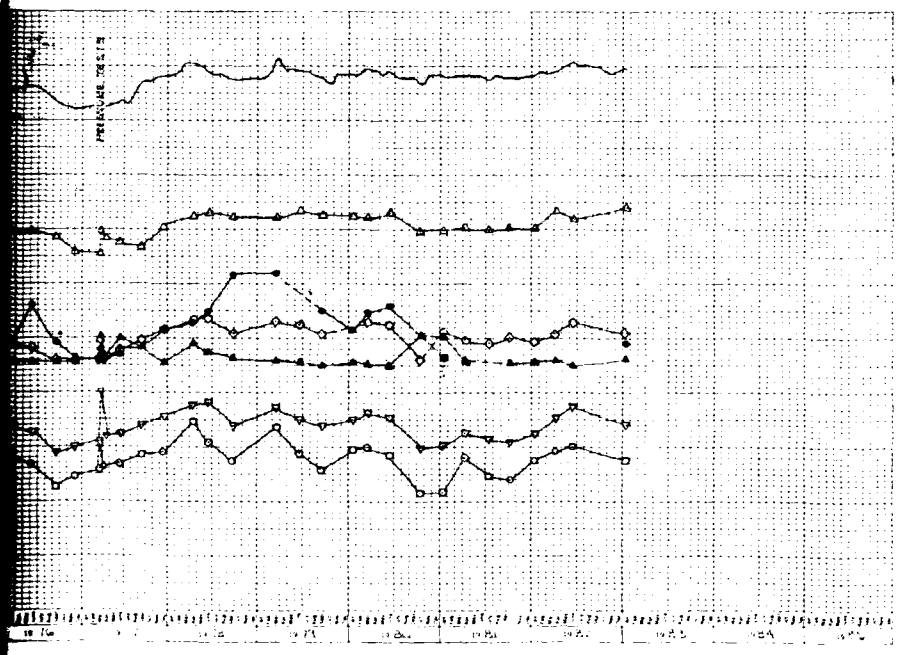

ELEVATION IN FEET MSL
1340
1320
1280
1260
1240
1220
1200
Grave. Slope Protection
ALLUVIUM CLAY
400
360
320
280
240




LEGEND



TYPICAL SECTION



DATE	DESCRIPTION	MADE	APPR'D
	REVISIONS		

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

DESIGNED BY
DRAWN BY
CHECKED BY
SUBMITTED BY
CHIEF SECTION
RECOMMENDED:
CHIEF BRANCH

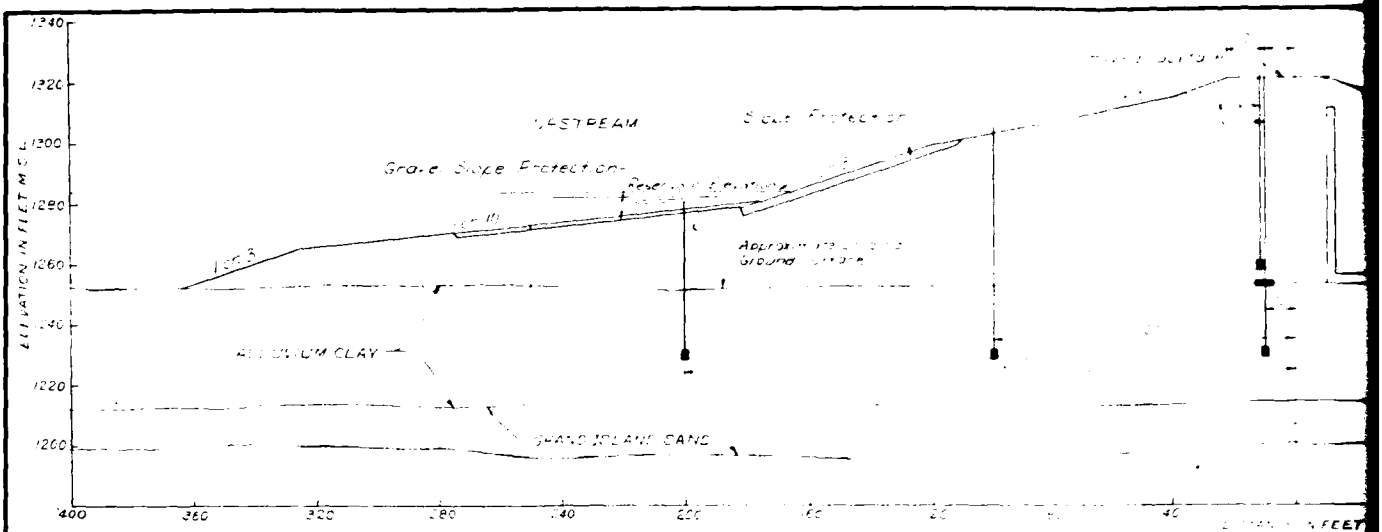
APPROVED
CHIEF ENGINEERING DIVISION
DATE

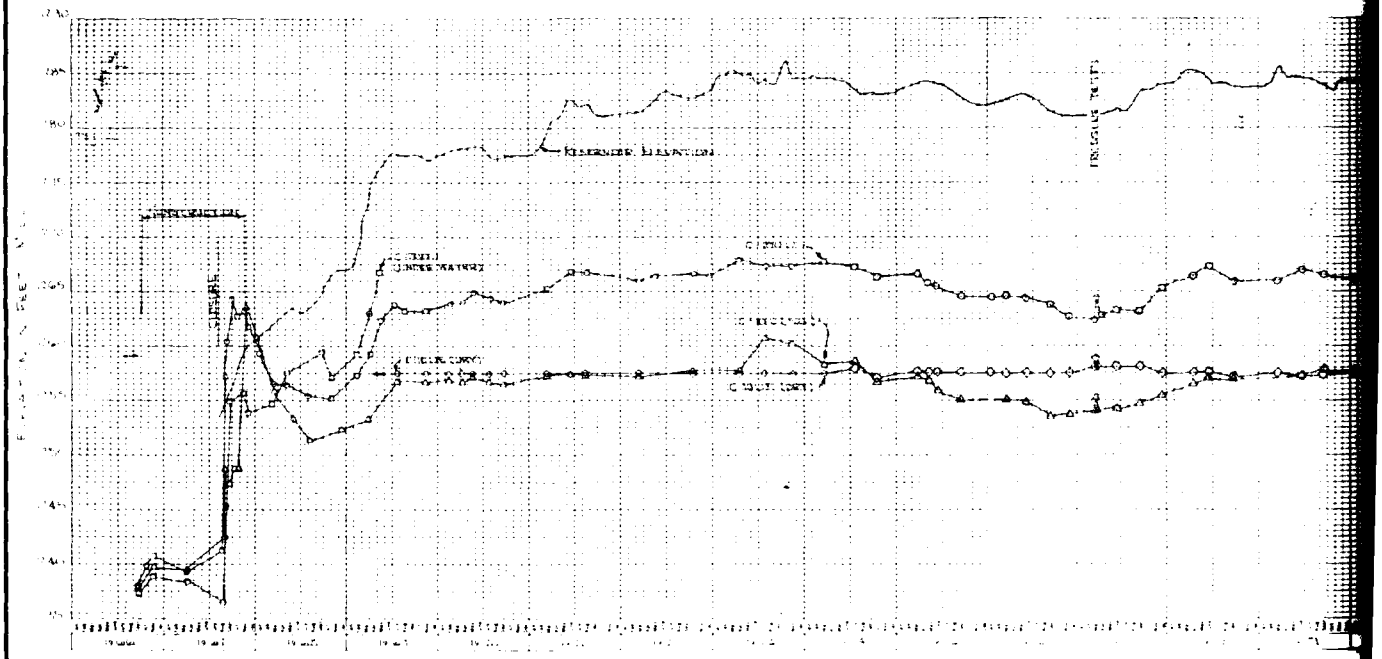
APPROVED
COL. U. S. C. DISTRICT ENGINEER

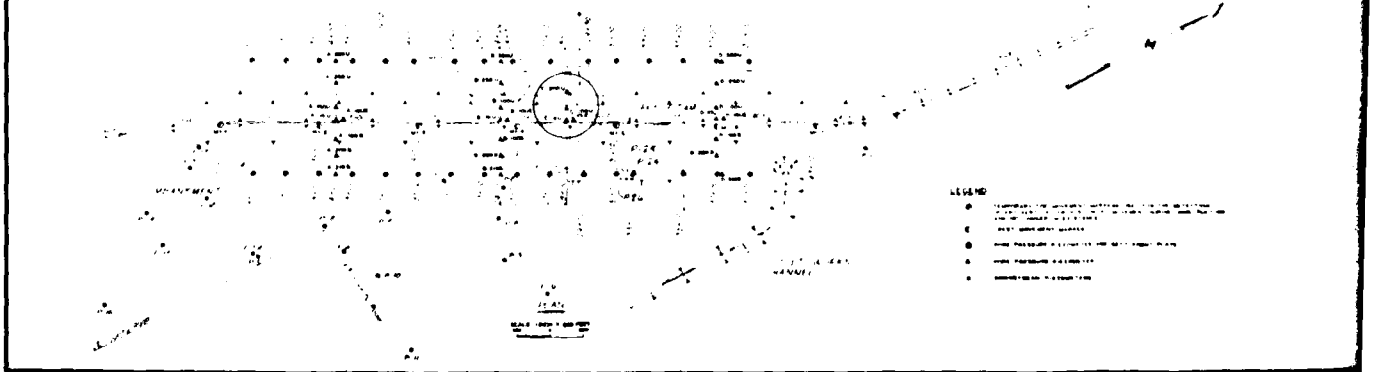
SCALE AS SHOWN
SPEC. NO.
DRAWING NUMBER
SHEET

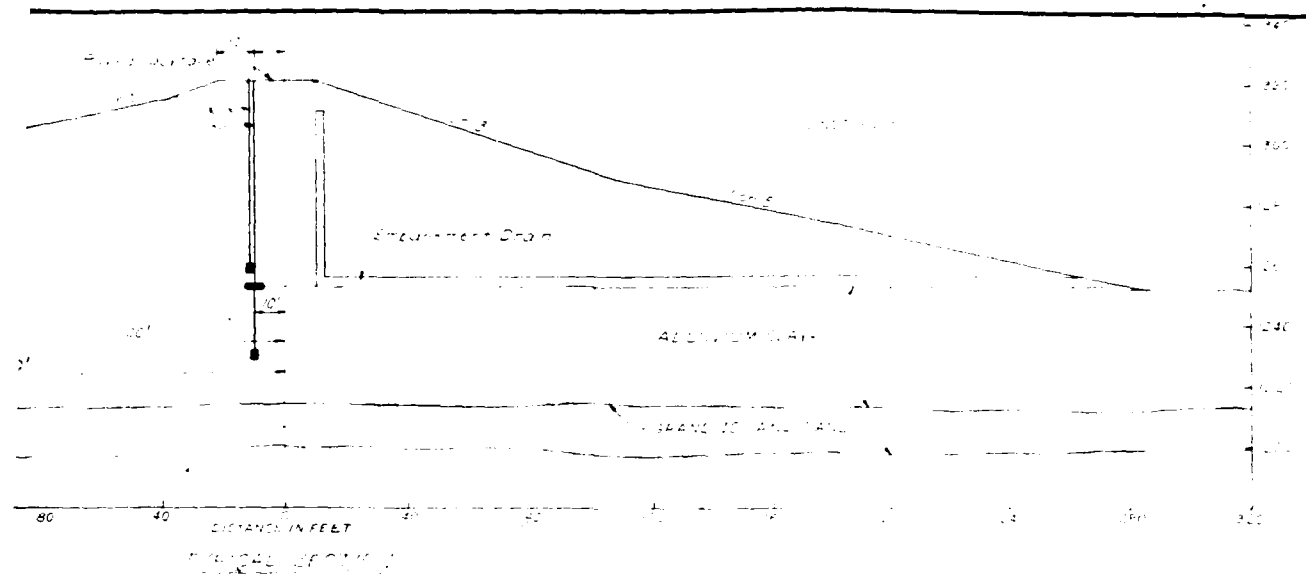
THIS PLAN ACCOMPANIES CONTRACT No.
MODIFICATION No.

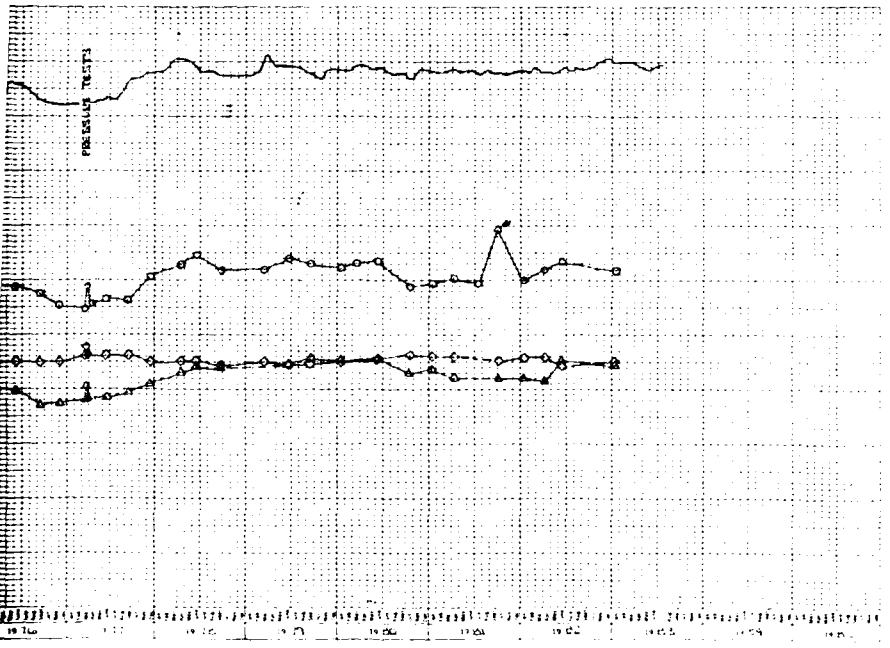
SAFETY DAYS


1340
1320
1300
1280
1260
1240
1220
1200
ELEVATION IN FEET M.S.L.
WESTBEAM
Grade Slope Protection
ALLUVIUM CLAY
GRAND ISLAND SAND
400
360
320
280
240
200
160
120
80
40
FEET


RESERVOIR ELEVATION
OUTSIDE WATER
CENTER LINE


LEGEND





SAFETY DAYS

THIS PLAN ACCOMPANIES CONTRACT NO
MODIFICATION NO.

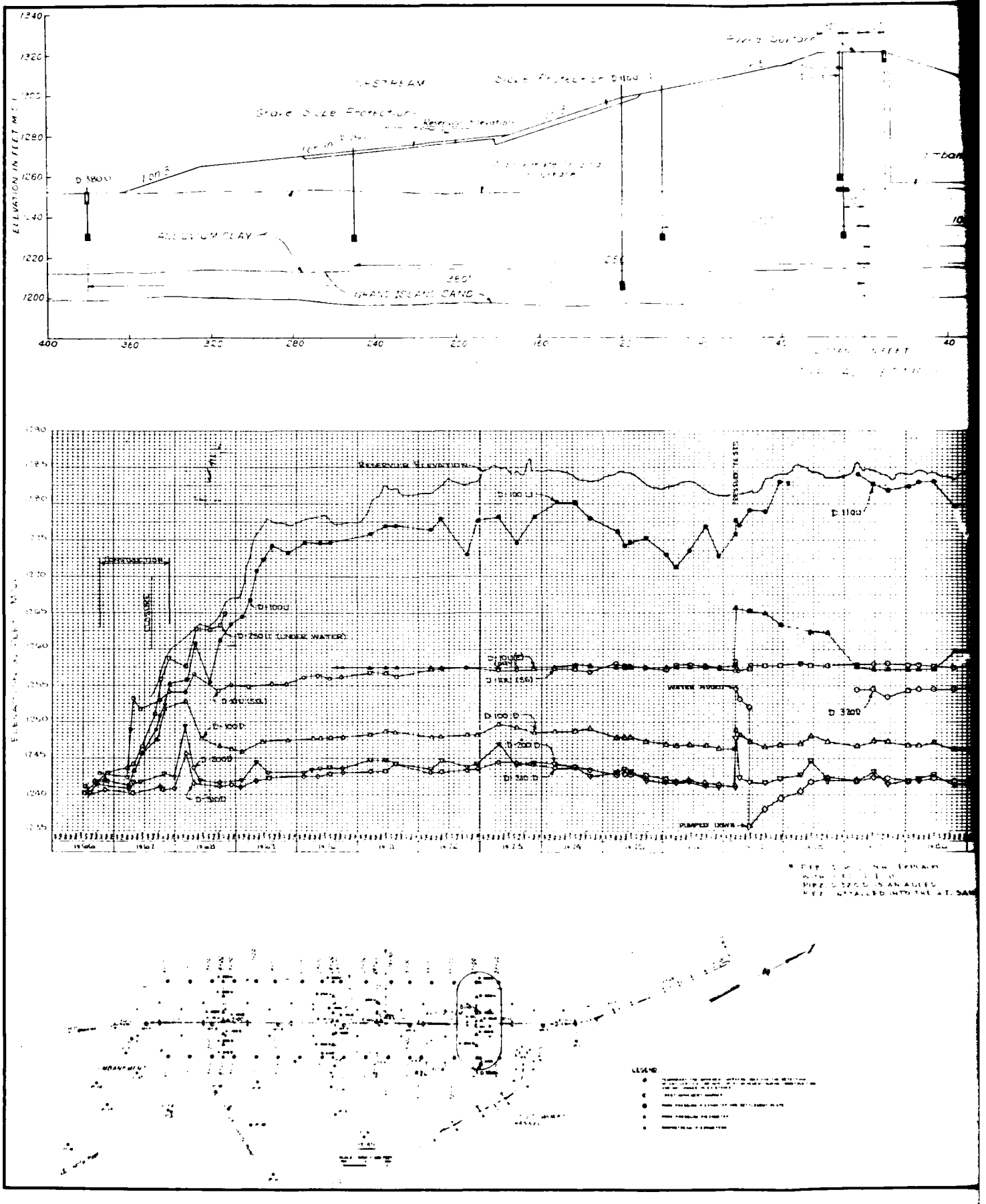
DATE	DESCRIPTION	MADE	APPR'D
	REVISIONS		

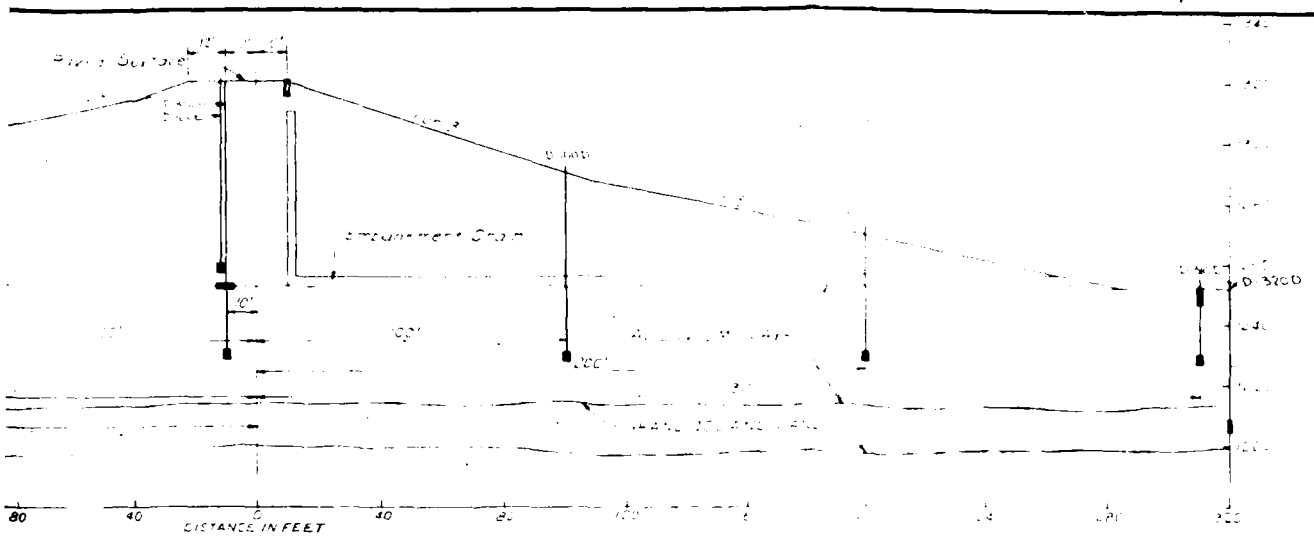
U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

DESIGNED BY:
DRAWN BY:
CHECKED BY:
SUBMITTED BY:
CHIEF SECTION
RECOMMENDED:
CHIEF BRANCH
APPROVED:
APPROVED
CHIEF ENGINEERING DIVISION
DATE
SCALE AS SHOWN
DATE
DRAWING NUMBER
SHEET
DIR. U. S. DISTRICT ENGINEER

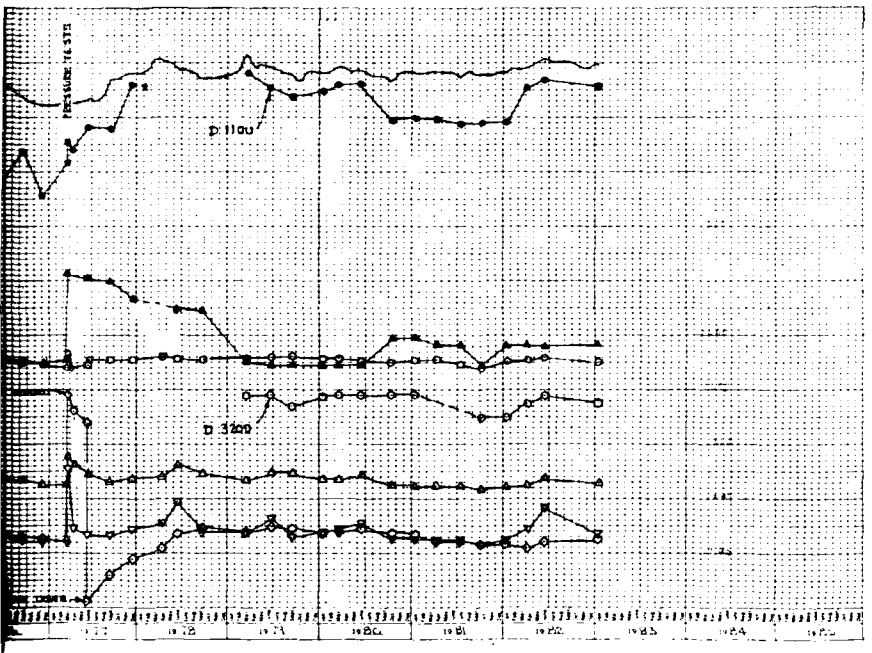
EMBANKMENT CRITERIA AND PERFORMANCE REPORT (1983)

PLATE C-4


ELEVATION IN FEET M.S.L.
1240
1220
1200
400
360
320
280
240
200
160
40
D 3800
ALLUVIUM CLAY
GRAND ISLAND SAND
FEET
Reservoir Elevation
D 1100
D 3200
D 1000
D 2000
D 3000
WATER LEVEL
PUMPED DOWN
LEGEND



TYPICAL SECTION



* PIEZ. D-1100 N.G. REPLACED WITH PIEZ. P1100
PIEZ. D 3200 IS AN ADDED PIEZ. INSTALLED INTO THE G.T. SAND.

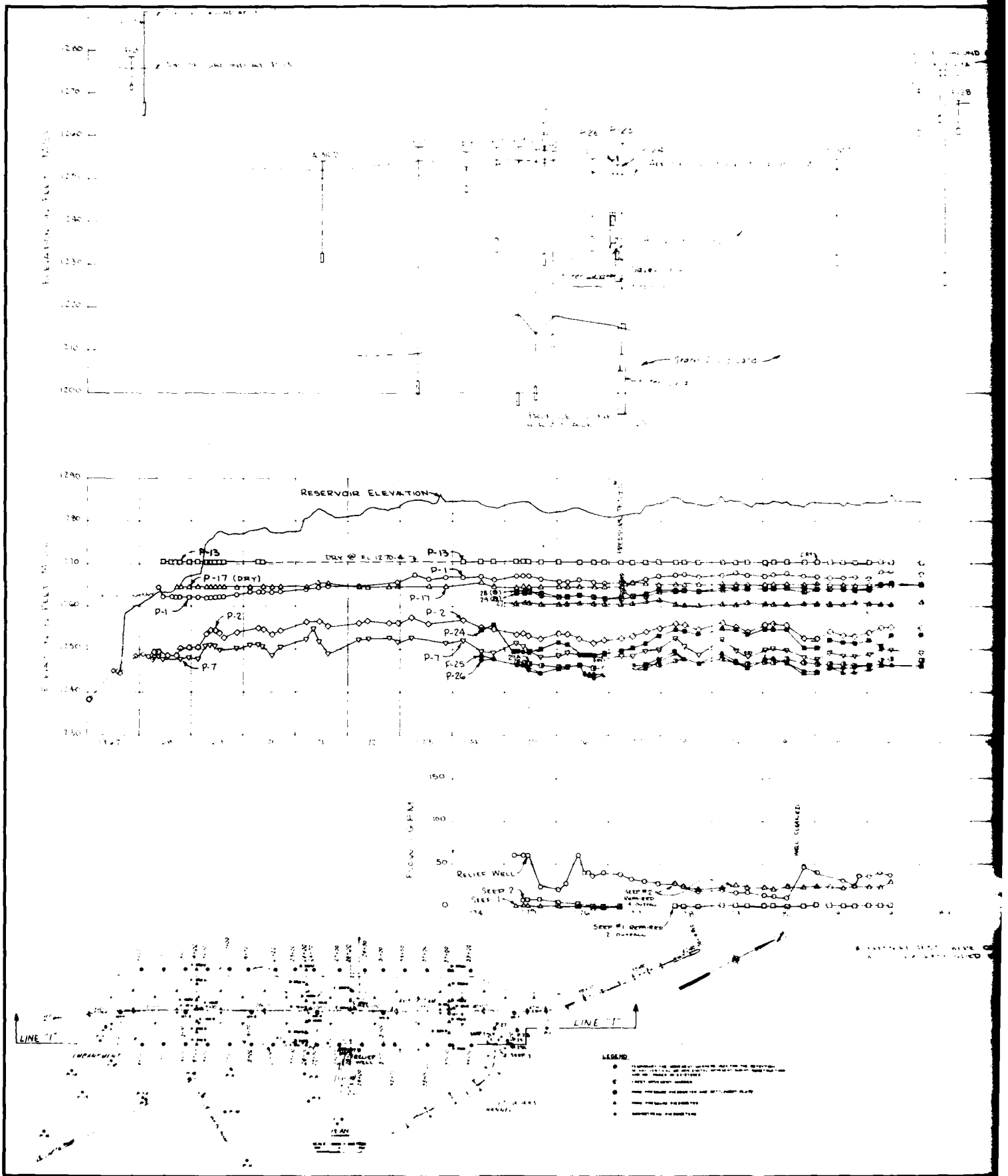
DATE	DESCRIPTION	MADE	APPR'D
	REVISIONS		

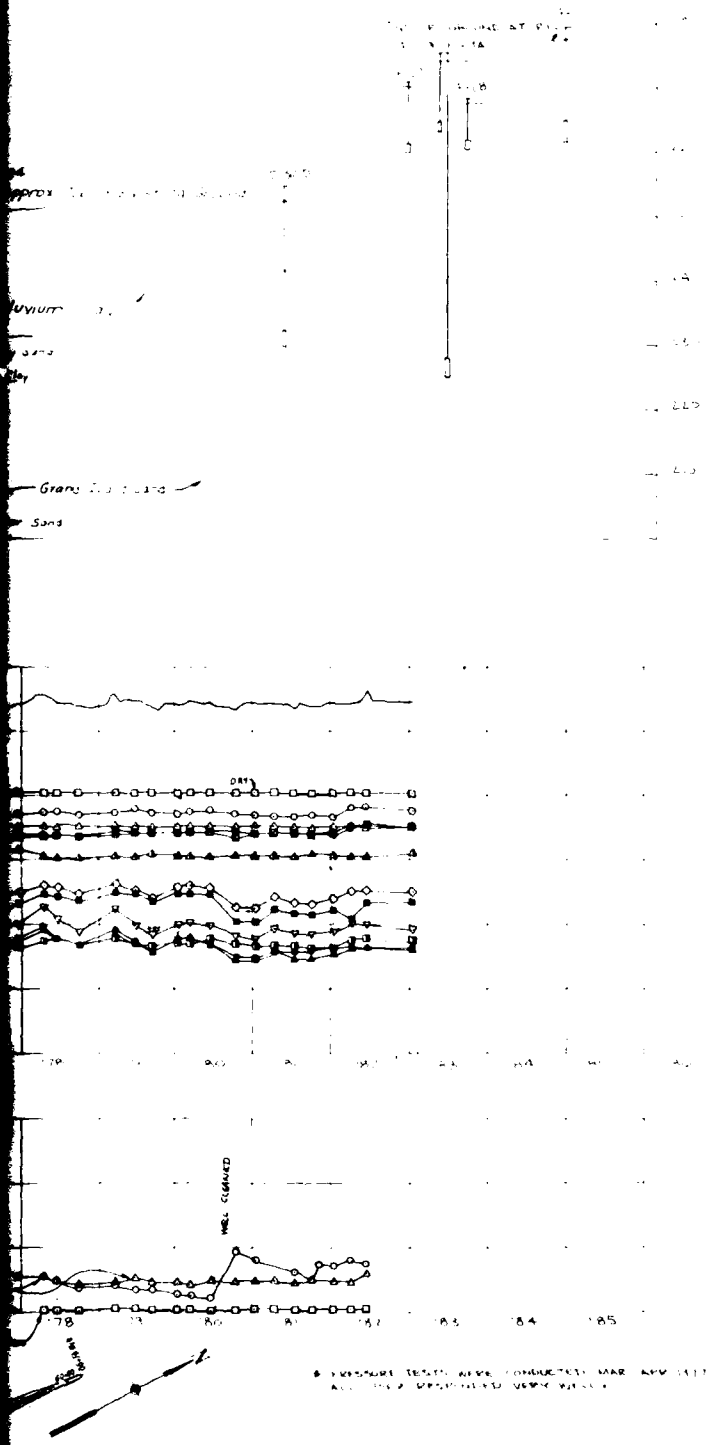
U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

DESIGNED BY:
DRAWN BY:
CHECKED BY:
SUBMITTED BY:
CHIEF SECTION
RECOMMENDED:
CHIEF BRANCH
APPROVED
CHIEF ENGINEERING DIVISION
DATE
APPROVED:
COL. C. E., DISTRICT ENGINEER
SCALE AS SHOWN
SPEC. NO.
SHEET

THIS PLAN ACCOMPANIES CONTRACT NO.
MODIFICATION NO.

SAFETY PAYS


RESERVOIR ELEVATION
P-13
P-17 (DRY)
P-1
P-2
P-7
P-24
P-25
P-26
RELIEF WELL
SEEP 2
LINE "I"
LEGEND



* PRESSURE TESTS WERE CONDUCTED MAR APR 1977
ALL HOLES DEVELOPED VERY WELL *

DATE	DESCRIPTION	MADE	APPRD

REVISIONS

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

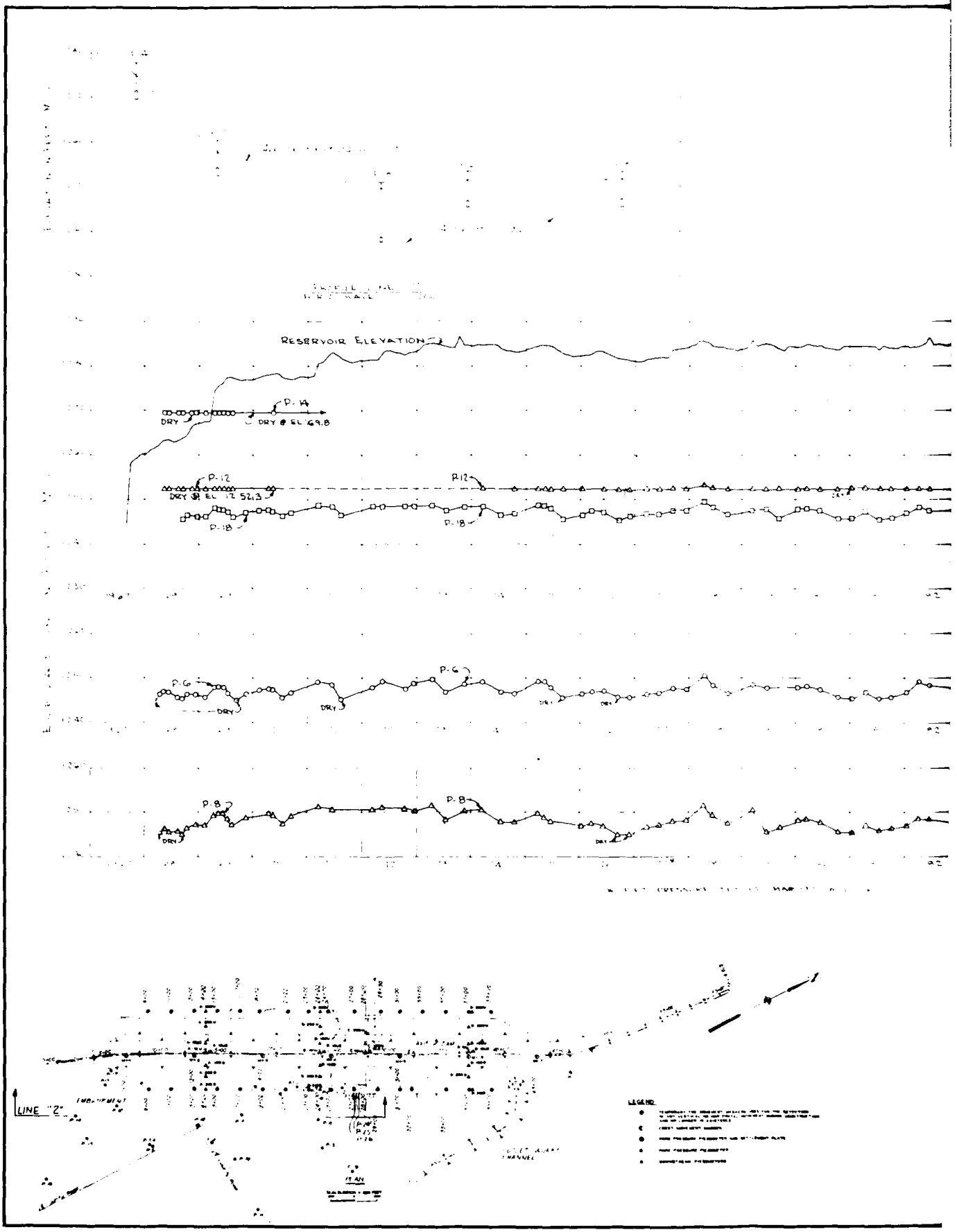
DESIGNED BY
DRAWN BY
CHECKED BY
SUBMITTED BY
CHIEF SECTION
SUPERVISED
CHIEF BRANCH
APPROVED
DIR. OF E. DISTRICT ENGINEER

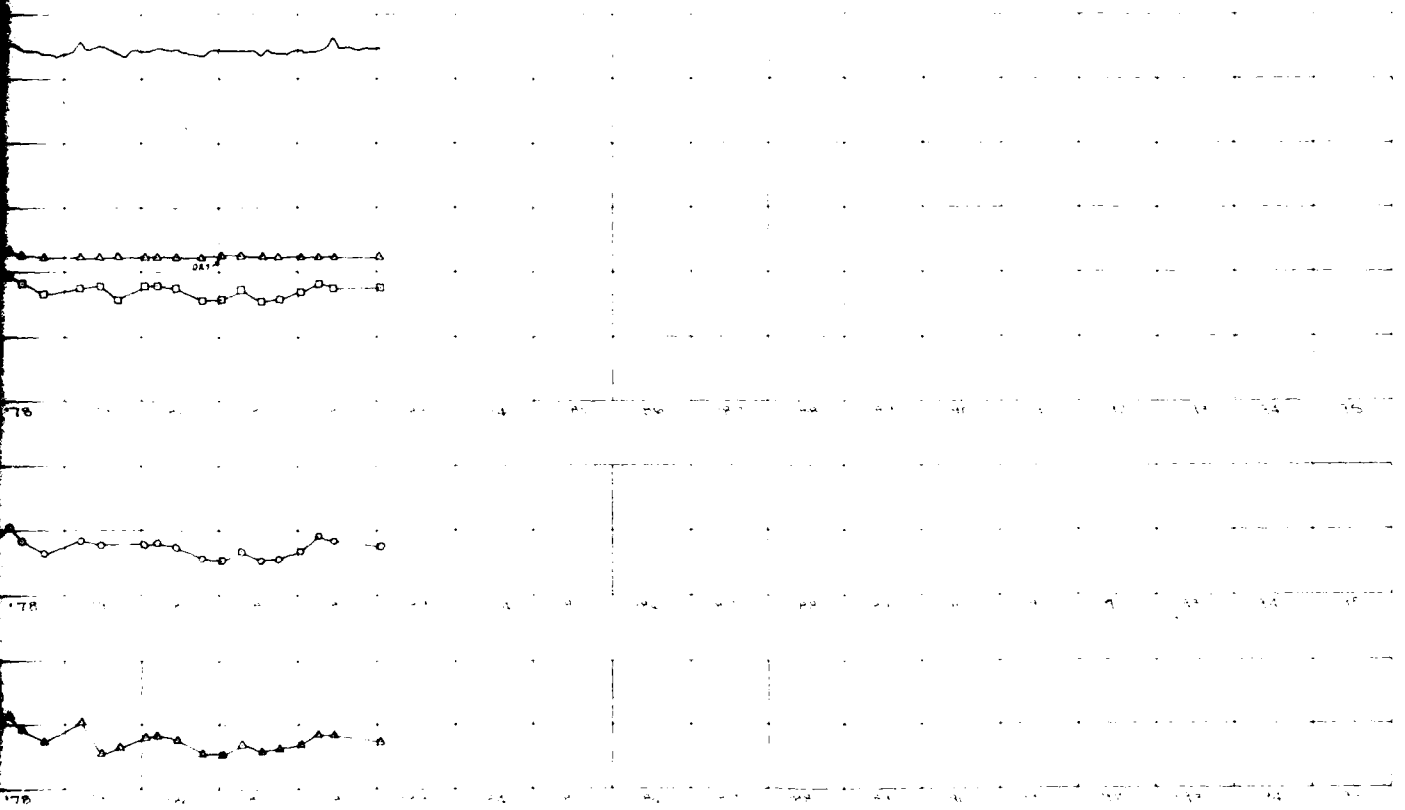
SITE 18
BRANCHED OAK DAM
LINE "1"
PIEZOMETER OBSERVATIONS

APPROVED
CHIEF ENGINEERING DIVISION
DATE
SCALE AS SHOWN
SPEC NO.
DRAWING NUMBER
SHEET

SAFETY PAYS

THIS PLAN ACCOMPANIES CONTRACT No.
MODIFICATION No.


RESERVOIR ELEVATION
P-14
DRY
DRY @ EL 69.8
P-12
DRY @ EL 12 52.3
P-18
P-6
DRY
P-8
DRY
LINE "Z"
LEGEND



DATE	DESCRIPTION	MADE	APPVD

REVISIONS

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

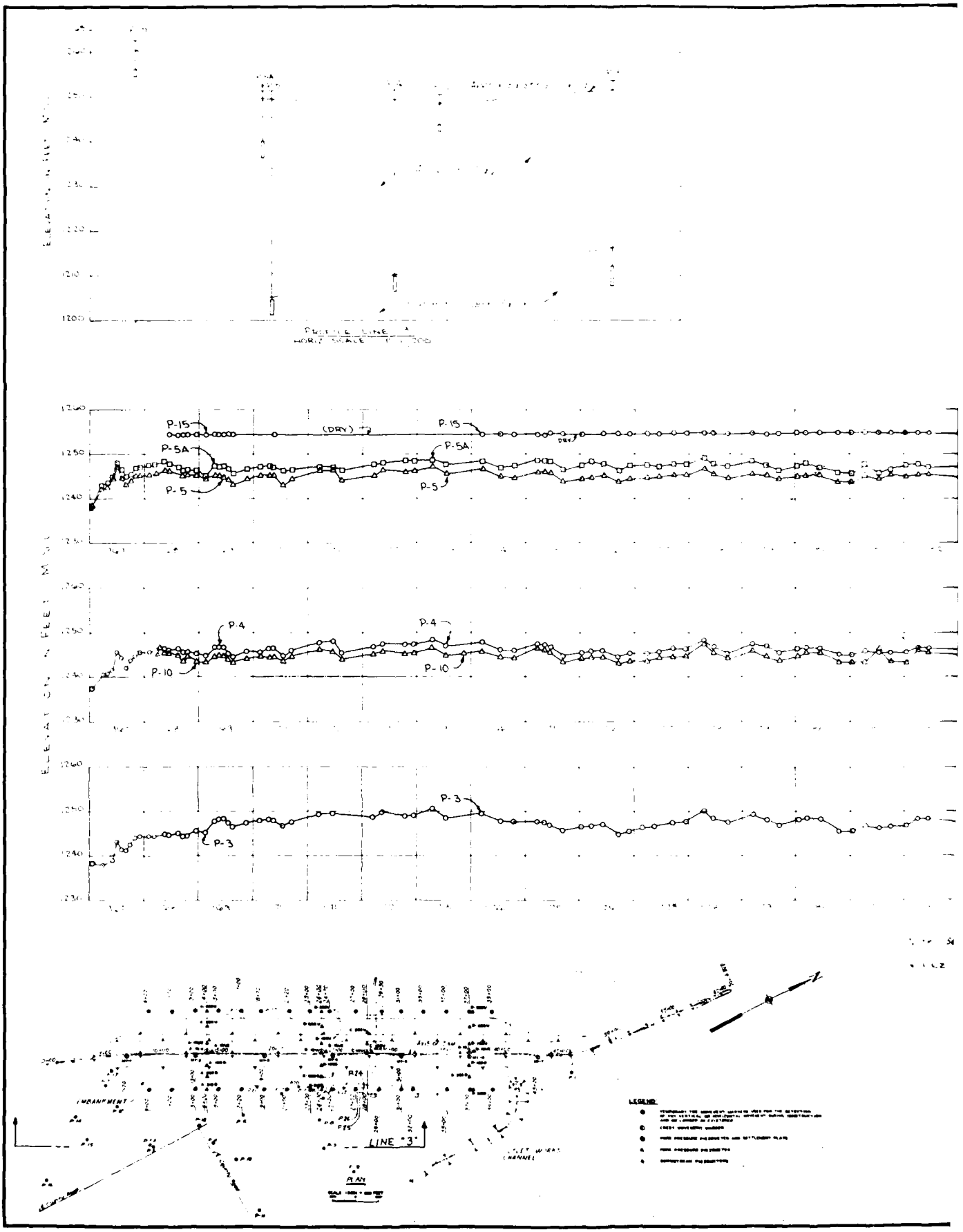
DESIGNED BY:
DRAWN BY:
CHECKED BY:
SUBMITTED BY:
CHIEF SECTION
RECOMMENDED:
CHIEF BRANCH
APPROVED:
DIST. ENGINEER

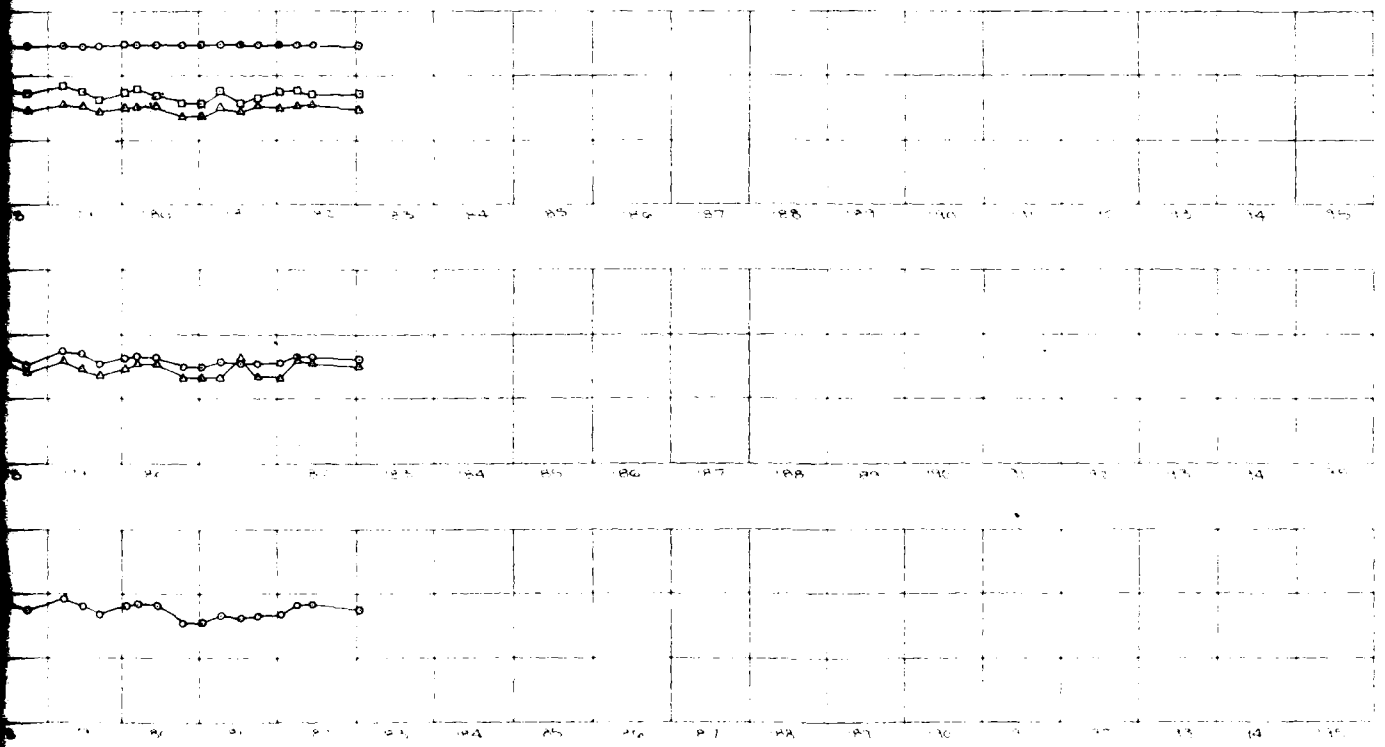
SALT CREEK AND ITS TRIBUTARIES, NEBR.
SITE 18
BRANCHED OAK DAM
LINE "2"
PIEZOMETER OBSERVATIONS

APPROVED: DATE
DIV. ENGINEER
SCALE AS SHOWN
SPEC. NO.
DRAWING NUMBER
SHEET

THIS PLAN ACCOMPANIES CONTRACT NO.
MODIFICATION NO.

SAFETY DAYS


P-15
(DRY)
P-15
DRY
P-5A
P-5A
P-5
P-5
P-4
P-4
P-10
P-10
P-3
P-3
LINE "3"
PLAN
LEGEND



Note see Plate C-6 for Reservoir Elevation

* PIEZ PRESSURE TESTED MAR '77, ALL OK

DATE	DESCRIPTION	MADE	APPRD
	REVISIONS		

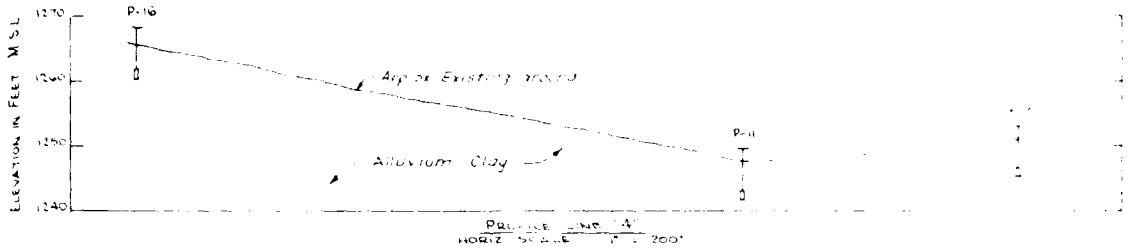
U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

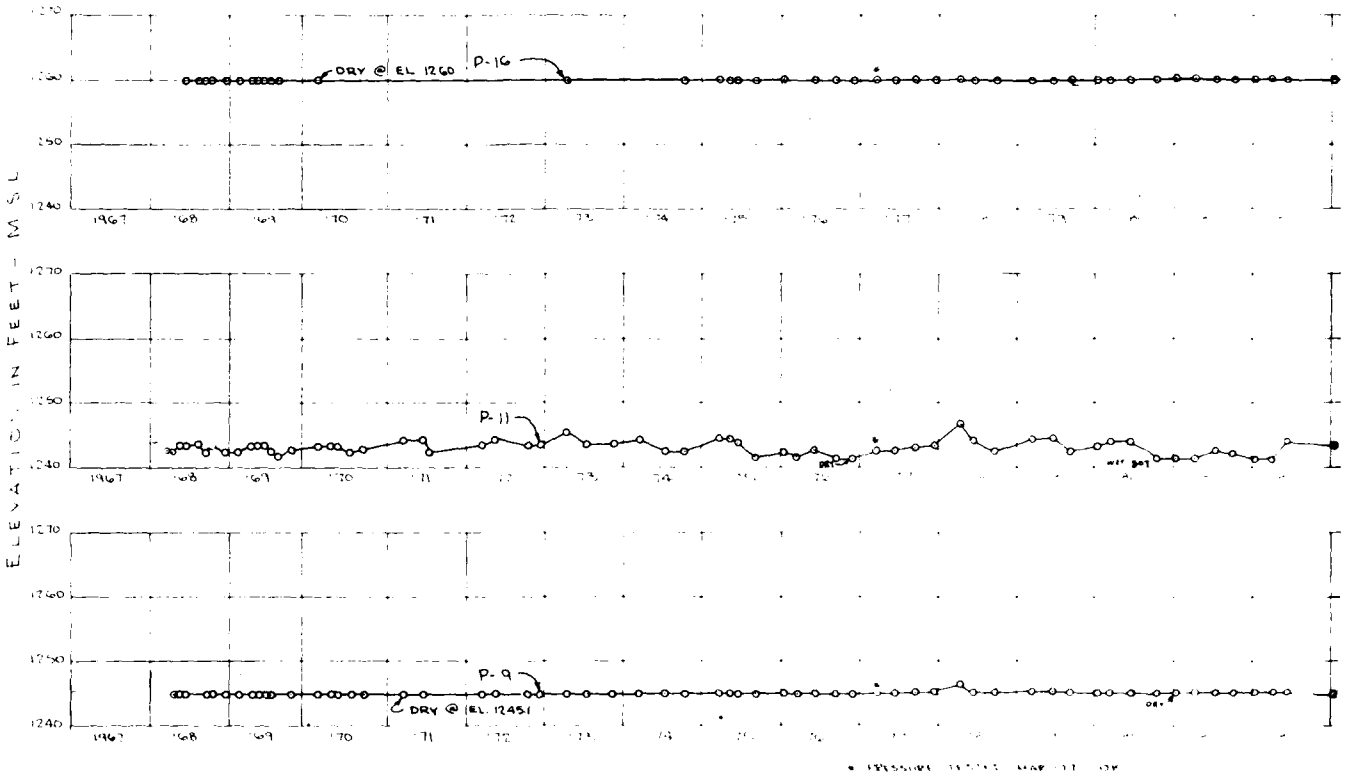
SALT CREEK AND ITS TRIBUTARIES NEBR
SITE 18
BRANCHED OAK DAM
LINE "3"
PIEZOMETER OBSERVATIONS

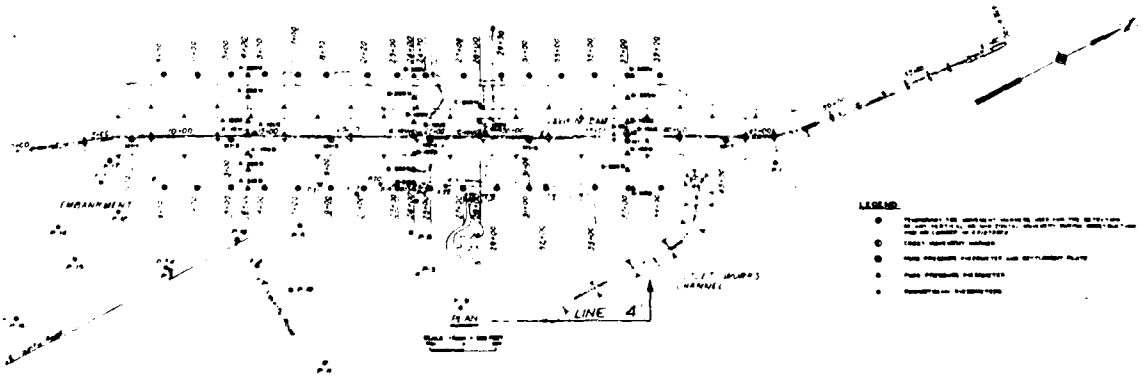
DESIGNED BY:
DRAWN BY:
CHECKED BY:
SUBMITTED BY:
SURV. SECTION
COMPARED:
SURV. TRAVERSE
APPROVED: CHIEF ENGINEERING DIVISION
DATE:
APPROVED: CHIEF, U. S. DISTRICT ENGINEER
SCALE: AS SHOWN
SPEC. NO.
DRAWING NUMBER
SHEET

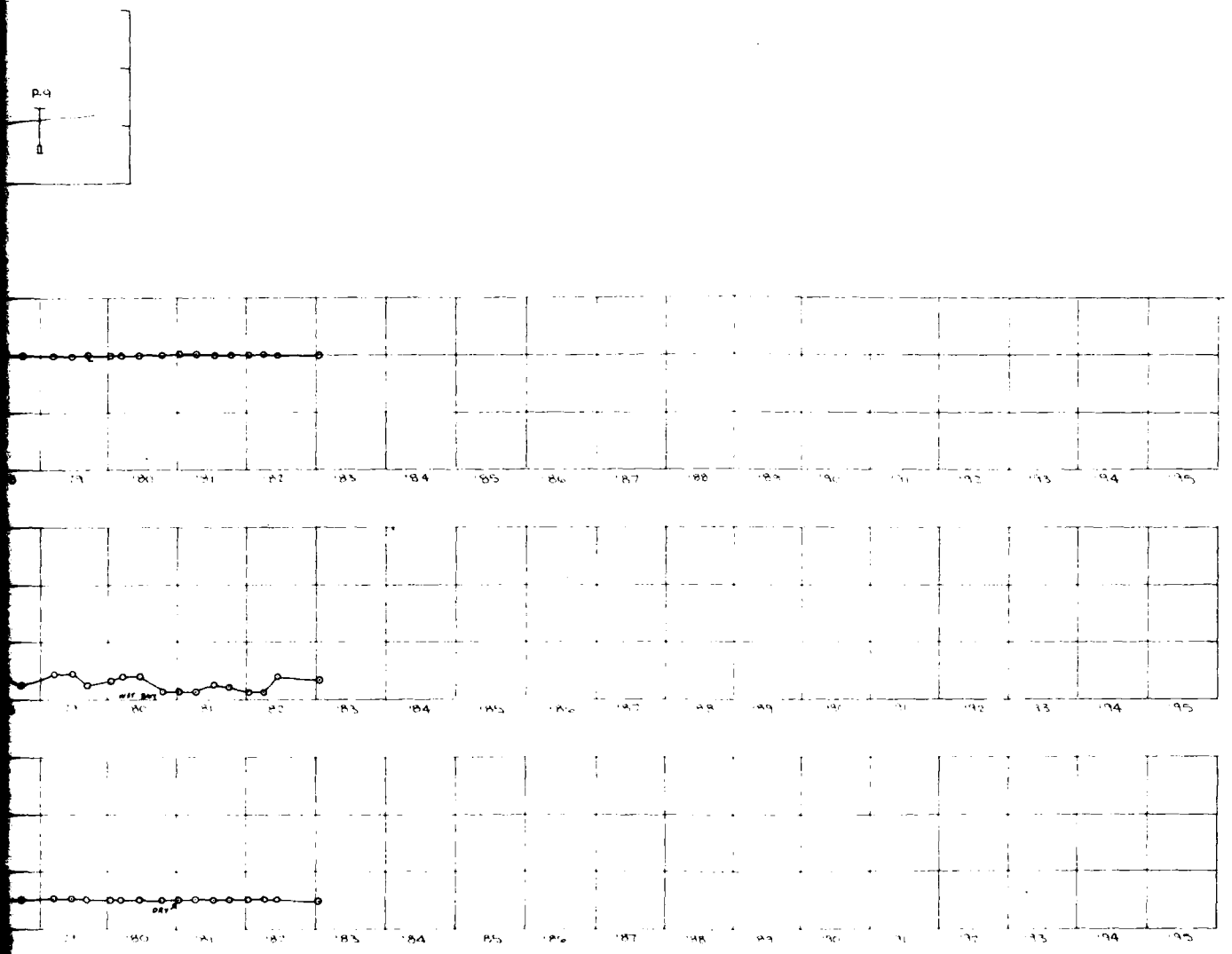
SAFETY PAYS

THIS PLAN ACCOMPANIES CONTRACT NO.
MODIFICATION NO.


P-16
P-11
Approx Existing Ground
Alluvium Clay
ELEVATION IN FEET MSL
1270
1260
1250
1240
PROFILE LINE A
HORIZ SCALE 1" = 200'


DRY @ EL 1260
P-16
P-11
P-9
DRY @ EL. 1245.1
ELEVATION IN FEET MSL
1270
1260
1250
1240
1967
68
69
70
71
72


EMBANKMENT
PLAN
LINE A
LEGEND



D MAR 77 - OK

Note See Plate C-6 for Reservoir Elevation

DATE	DESCRIPTION	ISSUE	APPVD
	REVISIONS		

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

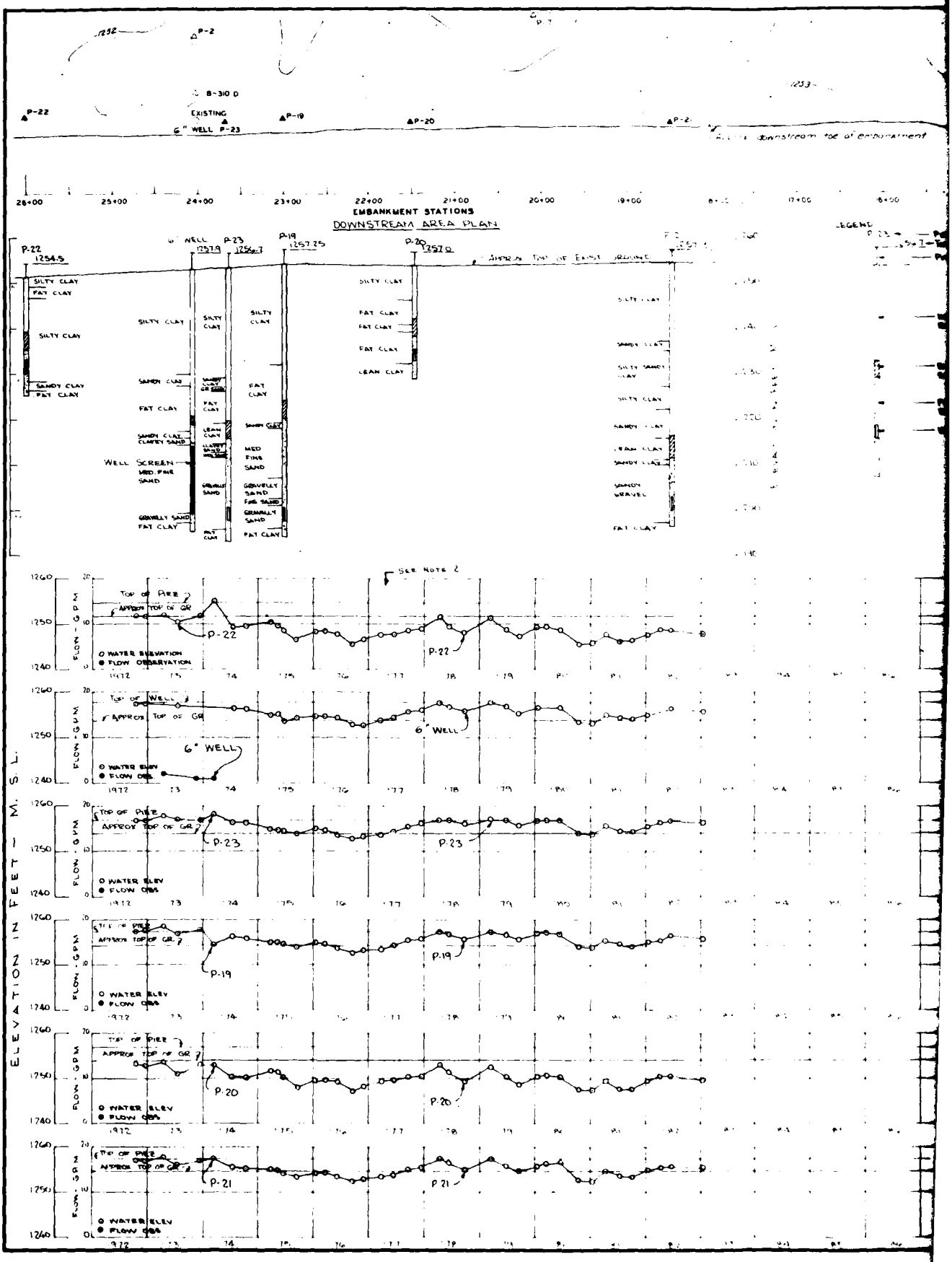
DESIGNED BY:
DRAWN BY:
CHECKED BY:
SUBMITTED BY:
CHIEF SECTION
ENGINEER:
CHIEF BRANCH

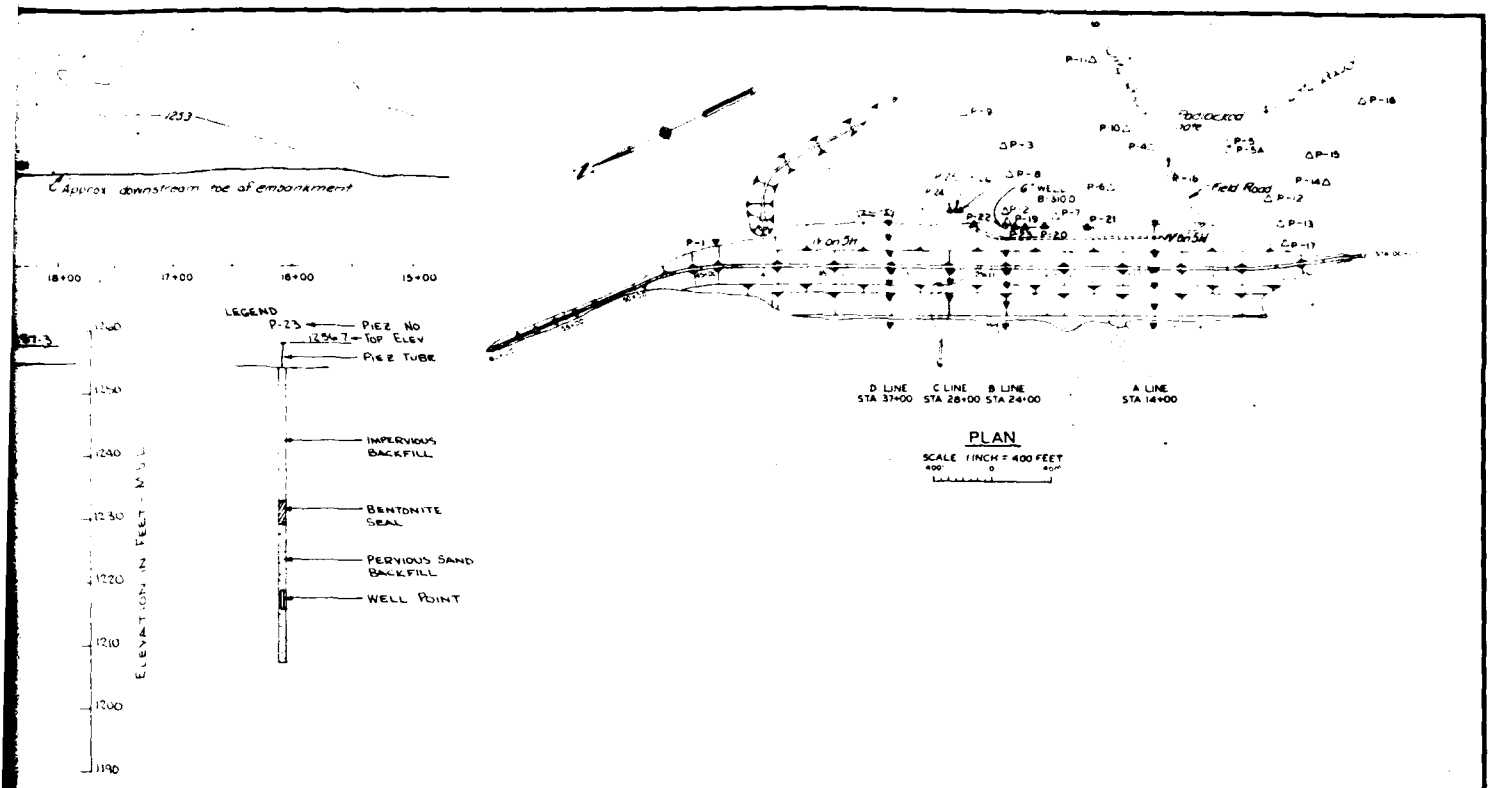
SALT CREEK AND IT'S TRIBUTARIES, NEBR
SITE 18
BRANCHED OAK DAM
LINE '4"
PIEZOMETER OBSERVATIONS

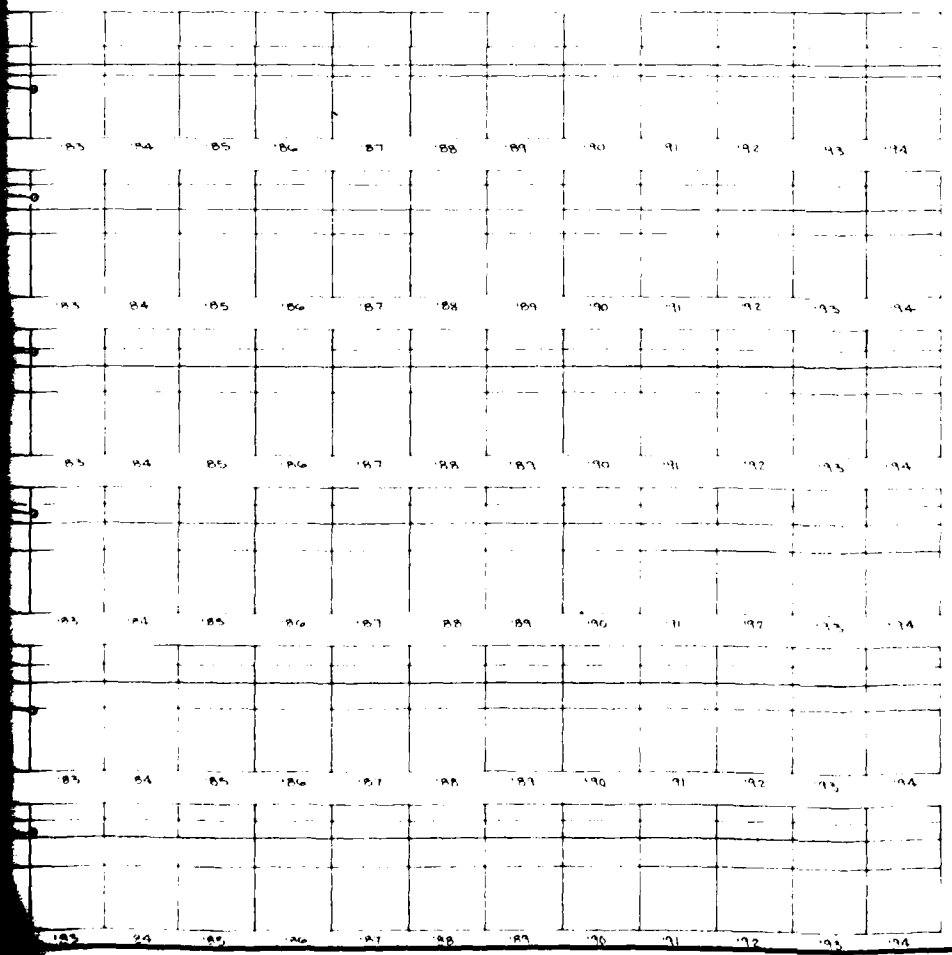
APPROVED
CHIEF ENGINEERING DIVISION
DATE
SCALE AS SHOWN
DRAWING NO.
APPROVED
DIST. U. S. DISTRICT ENGINEER
DRAWING CHECKED
SHEET

SAFETY PAYS

THIS PLAN ACCOMPANIES CONTRACT NO.
MODIFICATION NO.


P-2
B-310 D
P-22
EXISTING 6" WELL P-23
P-19
P-20
downstream toe of embankment
28+00
25+00
24+00
23+00
22+00
21+00
20+00
19+00
17+00
16+00
EMBANKMENT STATIONS
DOWNSTREAM AREA PLAN
LEGEND
P-22 1254.5
6" WELL
P-23 1256.7
P-19 1257.25
P-20 1257.0
Approx Top of Existing Ground
SILTY CLAY
FAT CLAY
SANDY CLAY
SANDY CLAY FAT CLAY
SILTY SANDY CLAY
LEAN CLAY
SANDY GRAVEL
WELL SCREEN MED. FINE SAND
GRAVELLY SAND
GRAVELLY SAND FAT CLAY
MED FINE SAND
GRAVELLY SAND FINE SAND
SILTY SAND
ELEVATION IN FEET - M.S.L.
FLOW - G.P.M.
SEE NOTE 2
Top of Pipe
Approx Top of Gr
Top of Well
O WATER ELEVATION
● FLOW OBSERVATION
1260
1250
1240
1972
73
74
75
76
77
78
79
80
P-22
6" WELL
P-23
P-19
P-20
P-21





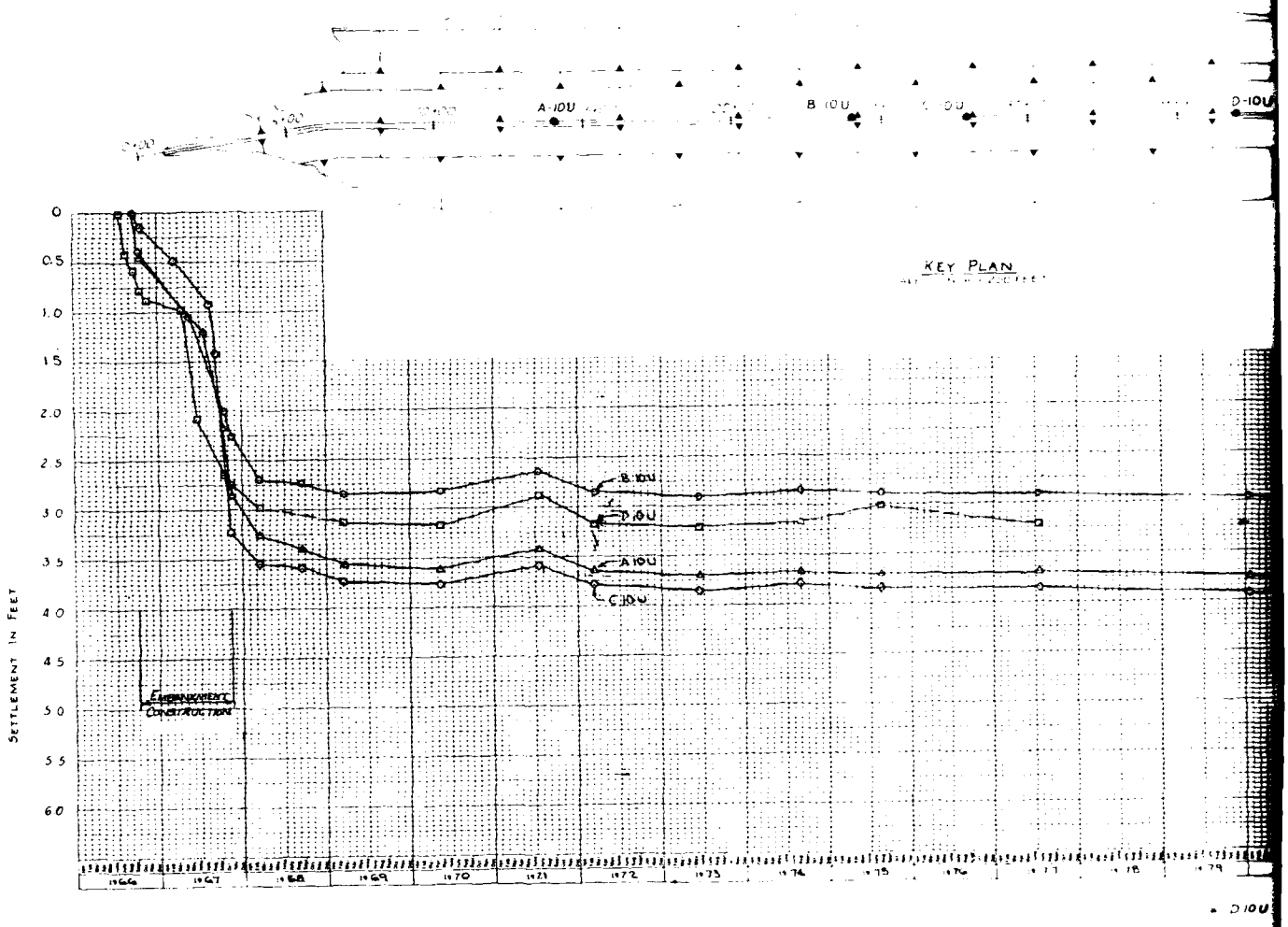
NOTE
See Plate C-6 for Reservoir Elevation
2 PIEZ PRESSURE TESTED MAR 77 ALL OF

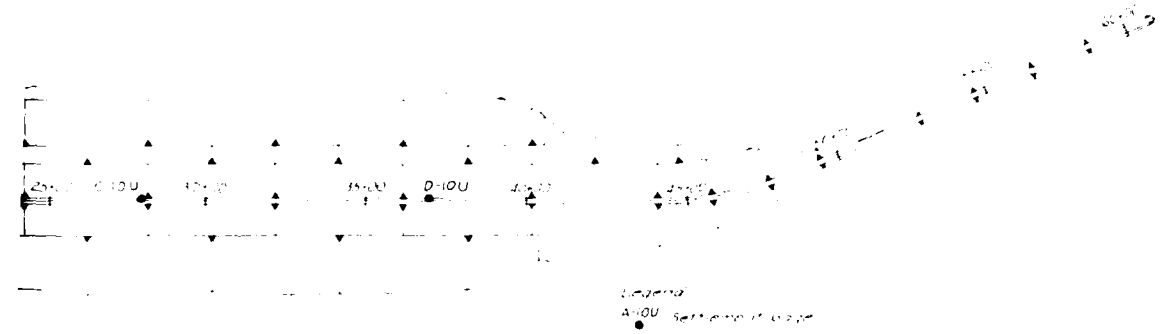
DATE	DESCRIPTION	MADE	APPD'D
	REVISIONS		

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

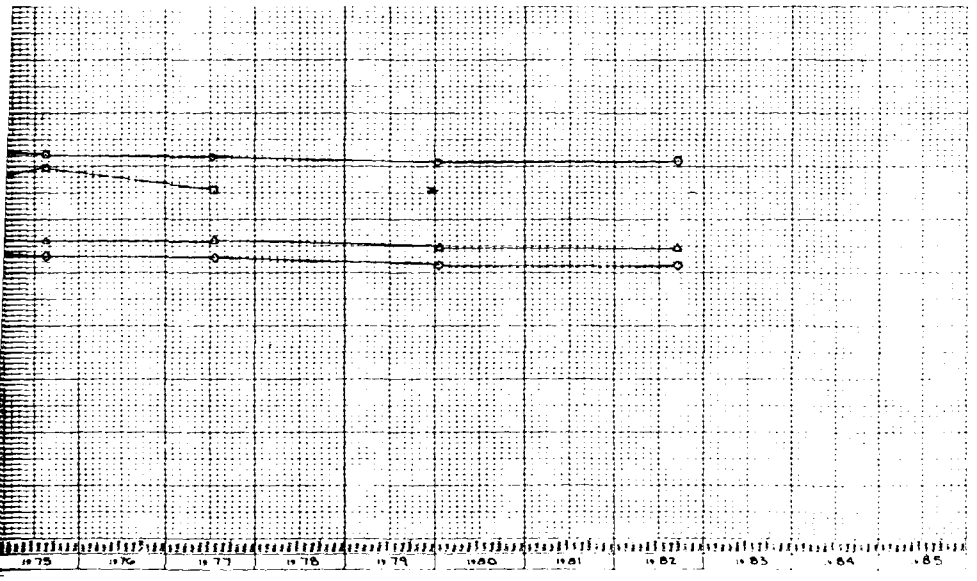
SALT CREEK AND ITS TRIBUTARIES, NEBRASKA
SITE 18
BRANCHED OAK DAM
DOWNSTREAM TOE PIEZOMETER OBSERVATIONS

DESIGNED BY:
DRAWN BY:
CHECKED BY:
SUBMITTED BY:
CHIEF SECTION
CHIEF DIVISION
APPROVED: DIST. ENGINEERING OFFICER — DATE
SCALE AS SHOWN — DRG. NO.
APPROVED: DIST. ENGINEER — CHIEF DIVISION
SHEET


A-10U
B-10U
D-10U
KEY PLAN
SETTLEMENT IN FEET
0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
B-10U
D-10U
A-10U
C-10U
EMBANKMENT CONSTRUCTION
1966
1967
1968
1969
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
D-10U



KEY PLAN

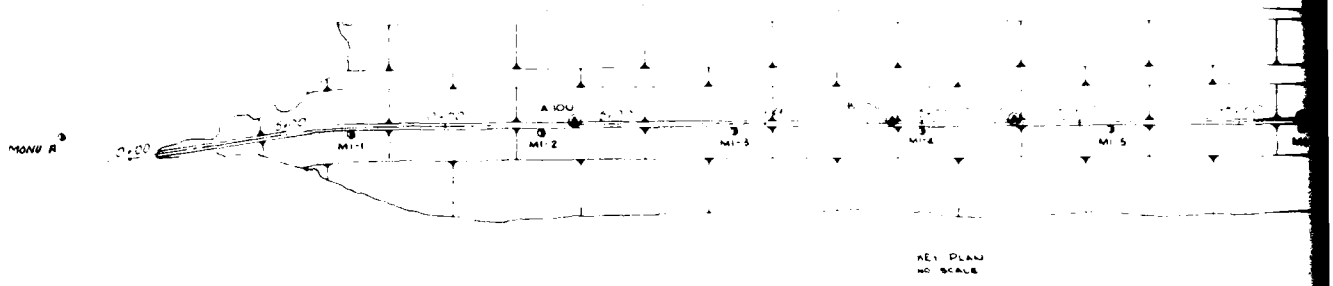


* D10U not surveyed Jan 80

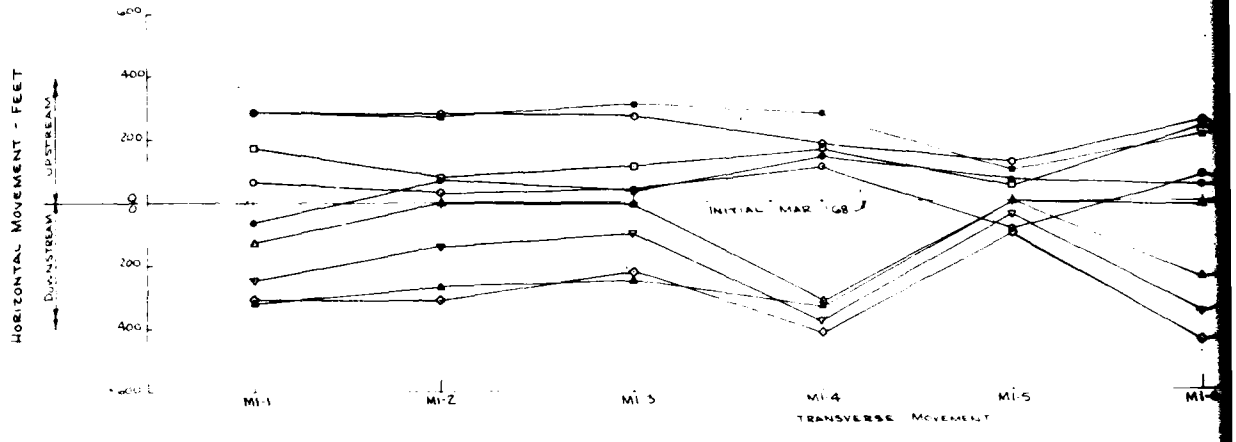
U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

BRANCHED OAK DAM & RESERVOIR
FOUNDATION SETTLEMENT DATA
VERTICAL MOVEMENT

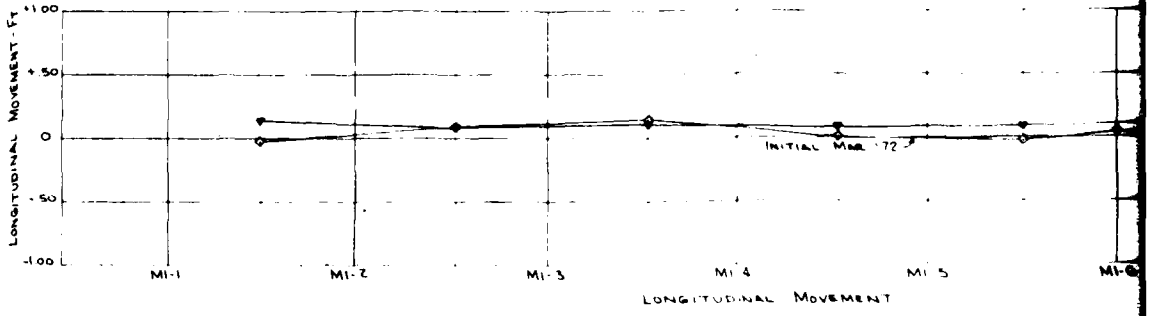
THIS PLAN ACCOMPANIES CONTRACT No.
MODIFICATION No.



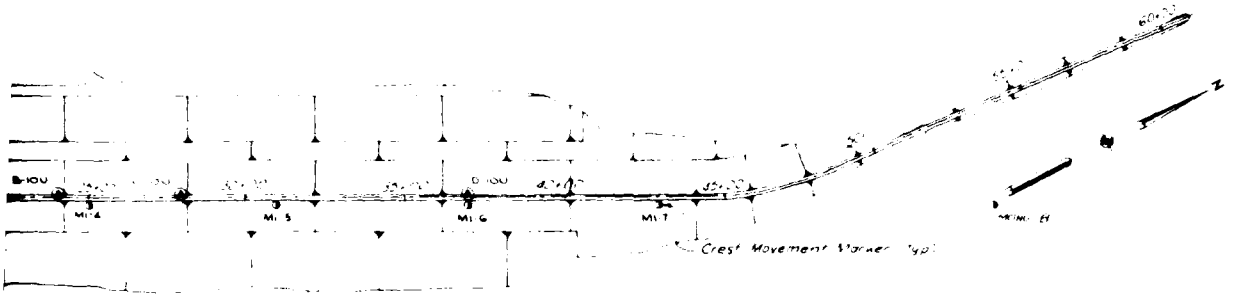
KEY PLAN
NO SCALE



TRANSVERSE MOVEMENT

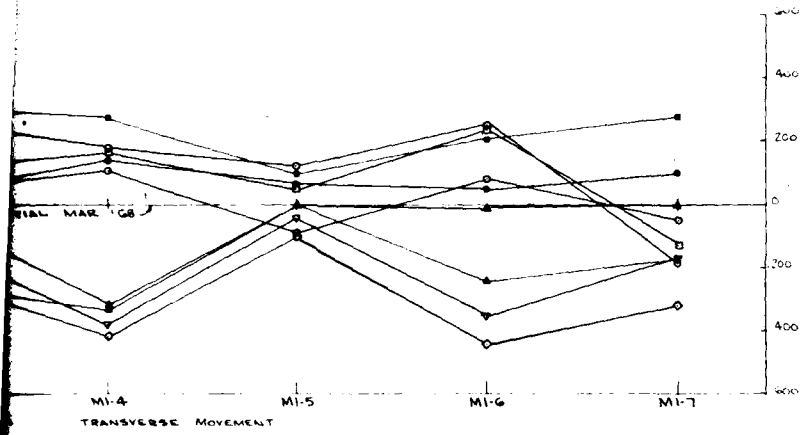


LONGITUDINAL MOVEMENT

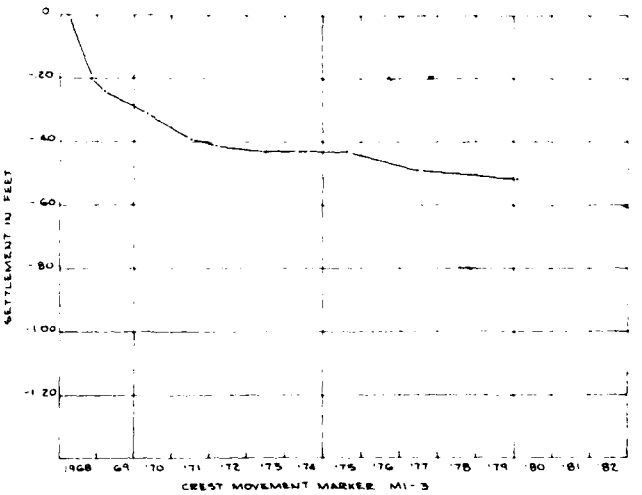


KEY PLAN
NO SCALE

LEGEND
- CREST MOVEMENT MARKERS
- FOUNDATION SETTLEMENT GAGE

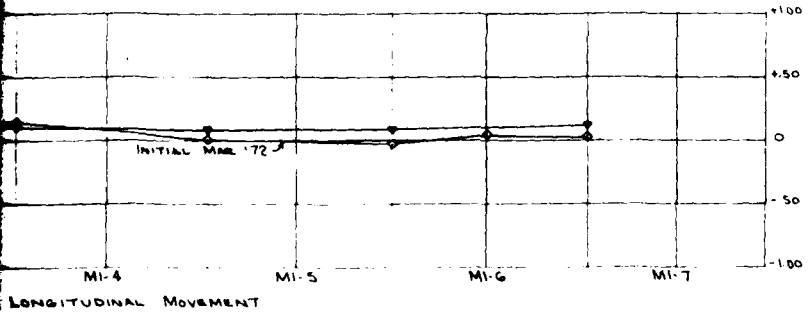


TRANSVERSE MOVEMENT



CREST MOVEMENT MARKER MI-3

LEGEND
- NOV '68
- MAR '69
- MAY '70
- JULY '71
- MAR '72
- JUNE '73
- AUG '74
- AUG '75
- JUL '77



LONGITUDINAL MOVEMENT

SAFETY PAYS

THIS PLAN ACCOMPANIES CONTRACT No.
MODIFICATION No.

DATE	DESCRIPTION	MADE	APPVD

REVISIONS

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

SALT CREEK AND ITS TRIBUTARIES, NEBRASKA

BRANCHED OAK DAM & RESERVOIR

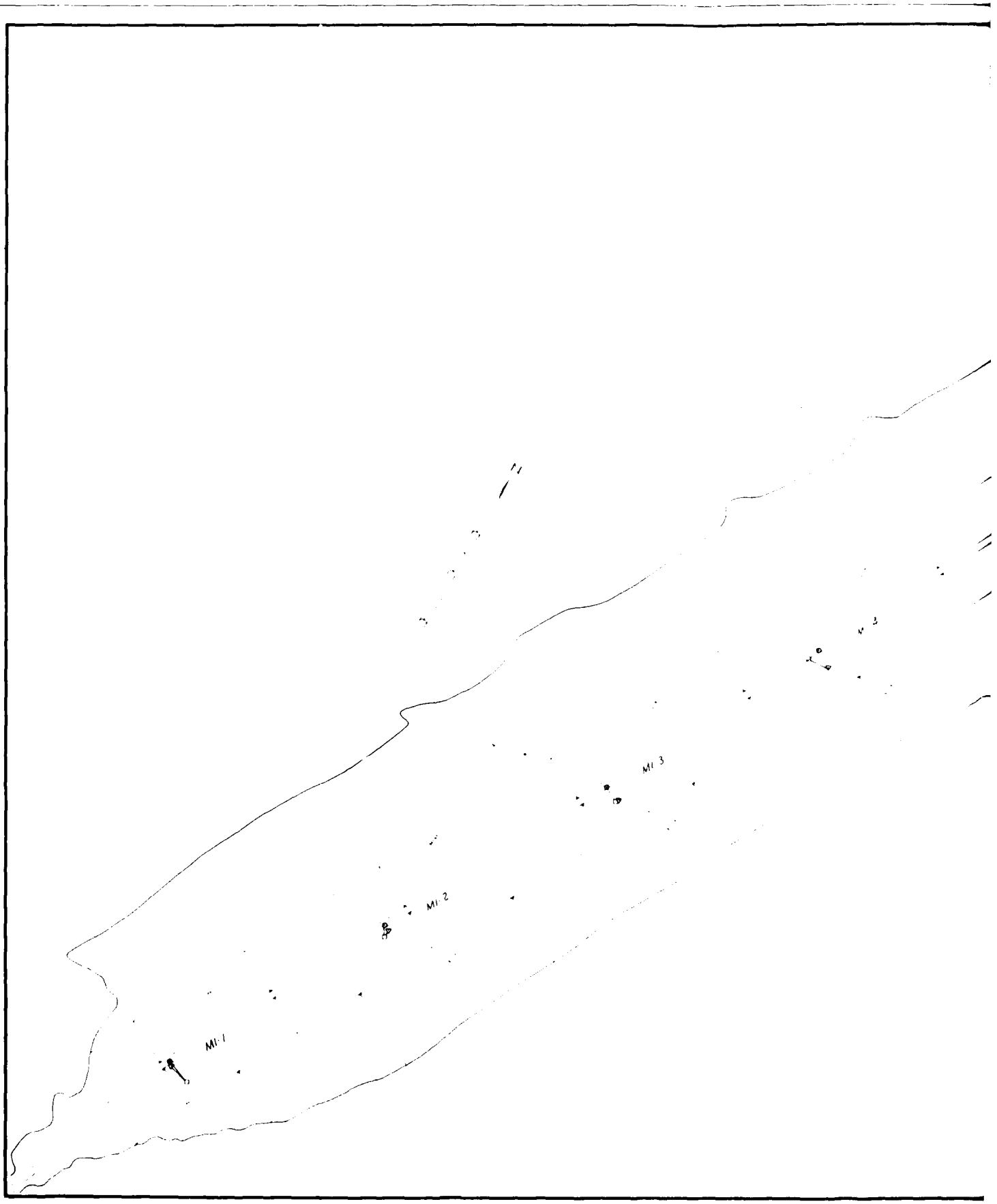
CREST MOVEMENT

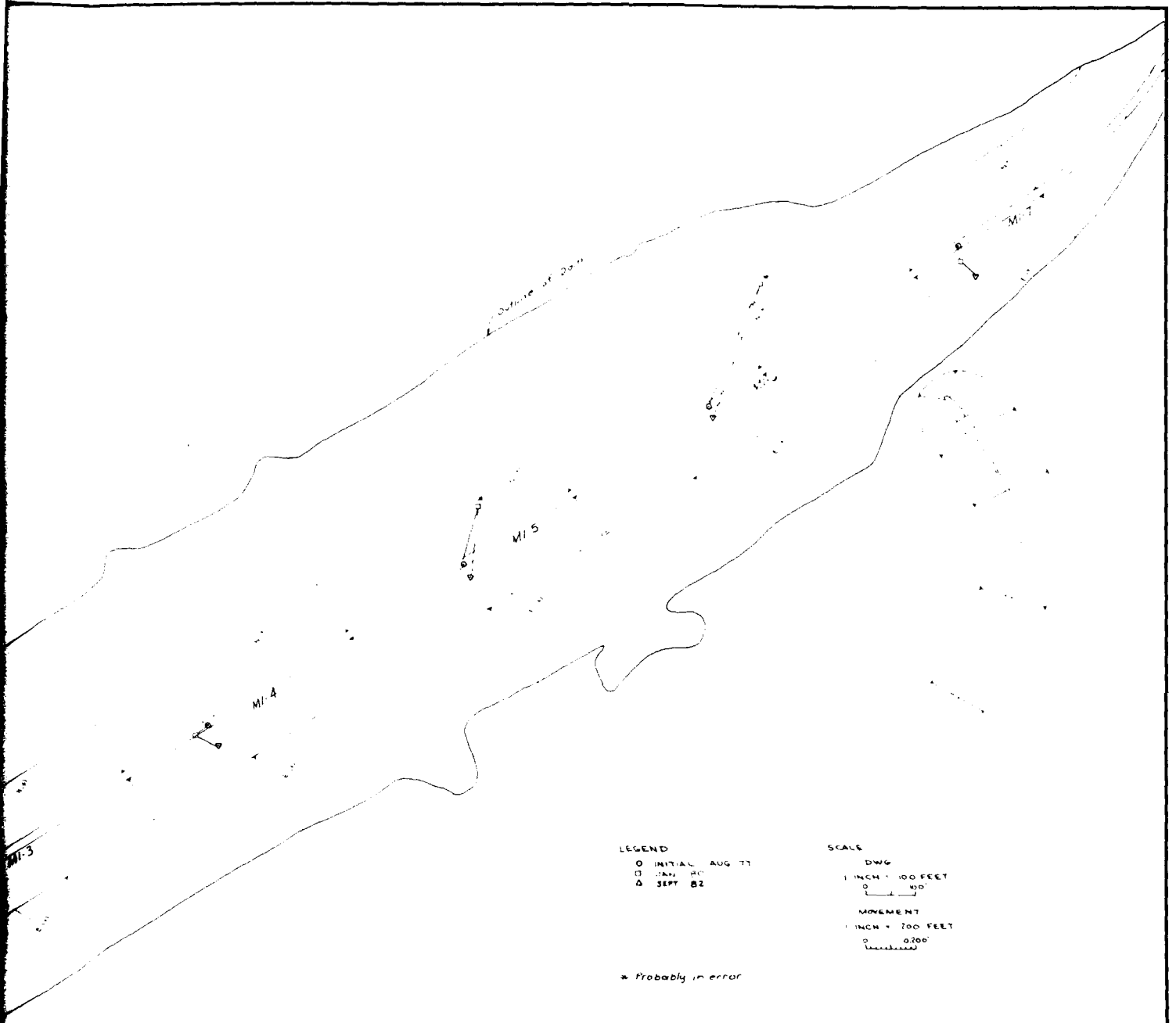
LONGITUDINAL, TRANSVERSE & VERTICAL MOVEMENT

DESIGNED BY
DRAWN BY
TRACED BY
CHECKED BY
CHIEF DESIGN
APPROVED
CHIEF DIVISION
APPROVED
CHIEF ENGINEERING DIVISION
APPROVED
CHIEF, U. S. ARMY ENGINEER DIVISION

APPROVED
DATE
SCALE AS SHOWN
DRAWING NUMBER
SHEET

EMBANKMENT CRITERIA AND PERFORMANCE REPORT (1983) PLATE C12


MI-1
MI-2
MI-3



LEGEND

- ○ INITIAL AUG 77
- □ JAN 82
- △ SEPT 82

SCALE

DWG

1 INCH = 100 FEET

0 100'

MOVEMENT

1 INCH = 200 FEET

0 0.200'

* Probably in error

DATE	DESCRIPTION	MADE	APPR'D
	REVISIONS		

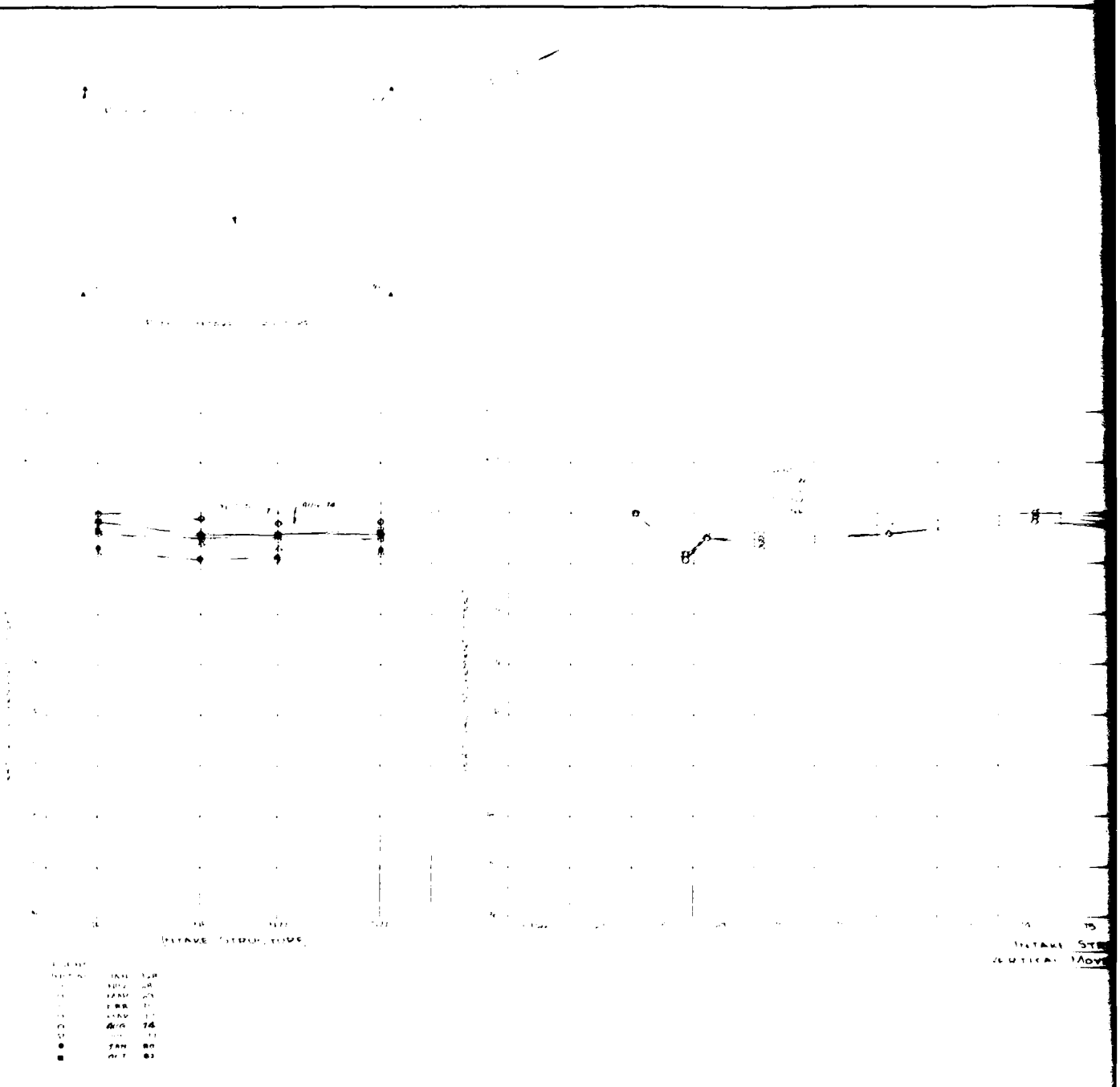
U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

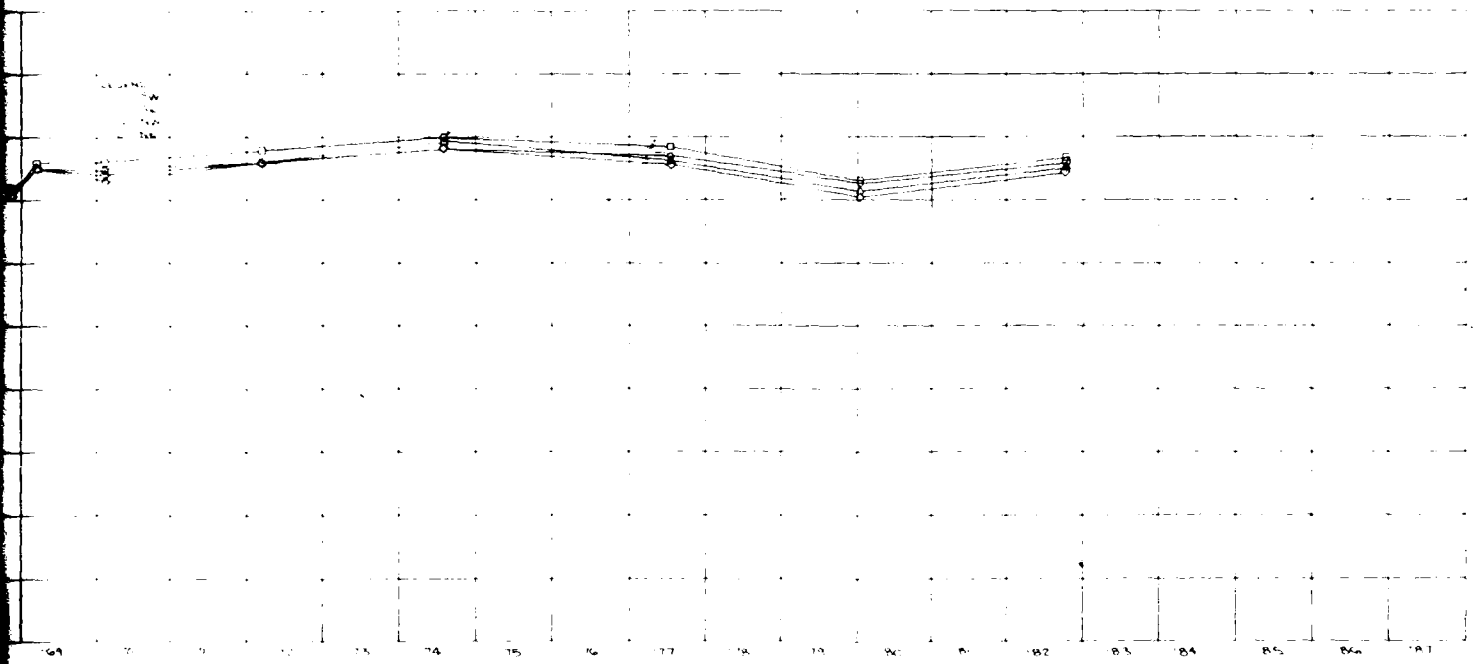
DESIGNED BY
DRAWN BY
TRACED BY
SUBMITTED BY
CHIEF SECTION
SUPERVISION
CHIEF BRANCH
APPROVED
APPROVED
CHIEF ENGINEERING DIVISION
DATE
SCALE AS SHOWN
SPEC NO.
DRAWING NUMBER
SHEET
CHIEF, E & C DISTRICT DESIGNER

SALT CREEK AND ITS TRIBUTARIES, NEBRASKA
BRANCHED OAK DAM
CREST MOVEMENT MARKERS
HORIZONTAL MOVEMENT

SAFETY PAYS

THIS PLAN ACCOMPANIES CONTRACT NO.
MODIFICATION NO.





INTAKE STRUCTURE
VERTICAL MOVEMENT Vs TIME

DATE	DESCRIPTION	NAME	APPVD
	REVISIONS		

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

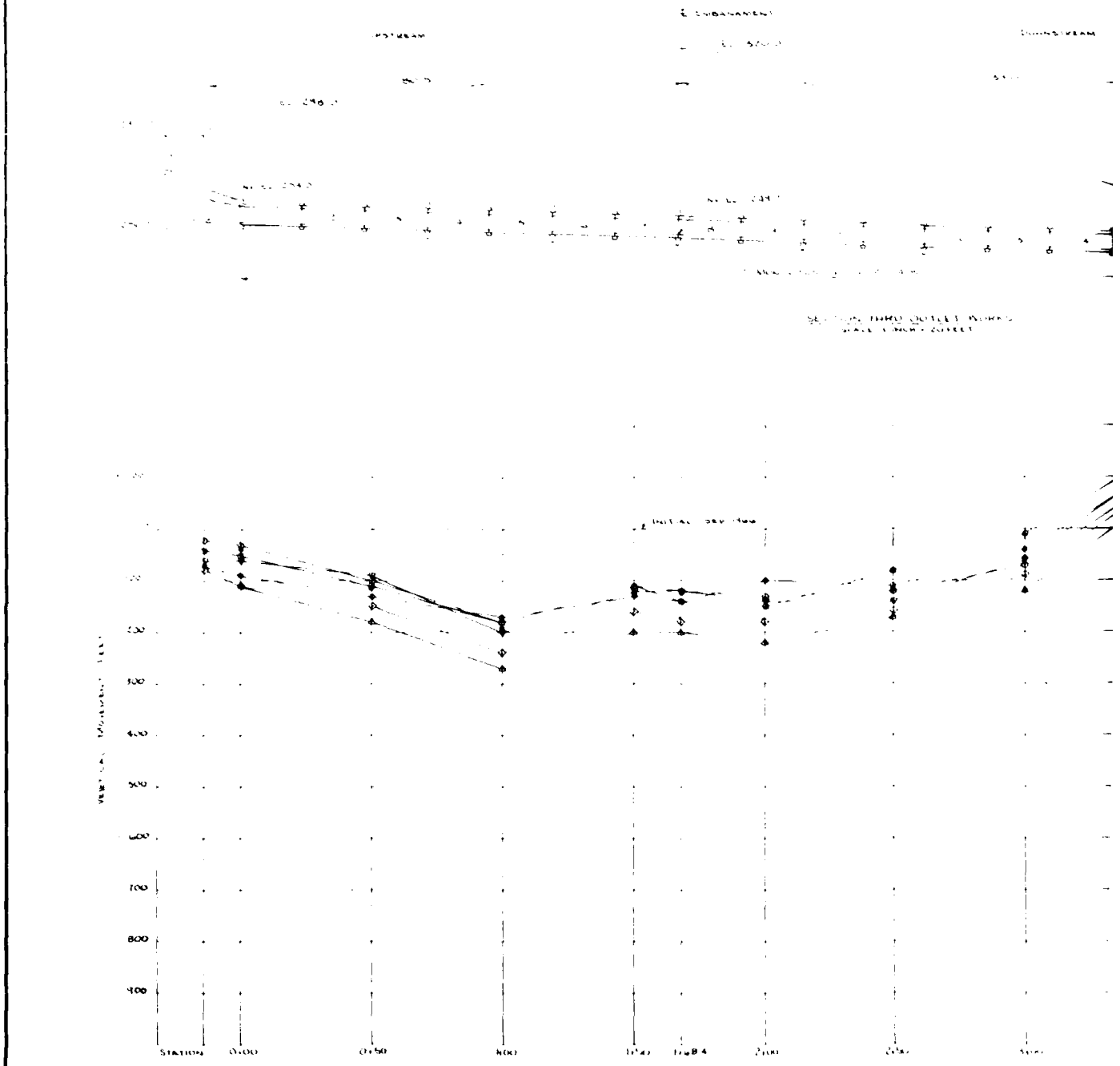
DESIGNED BY:
DRAWN BY:
CHECKED BY:
SUBMITTED BY:
CHIEF SECTION
SUPERVISED:
CHIEF DRAWING

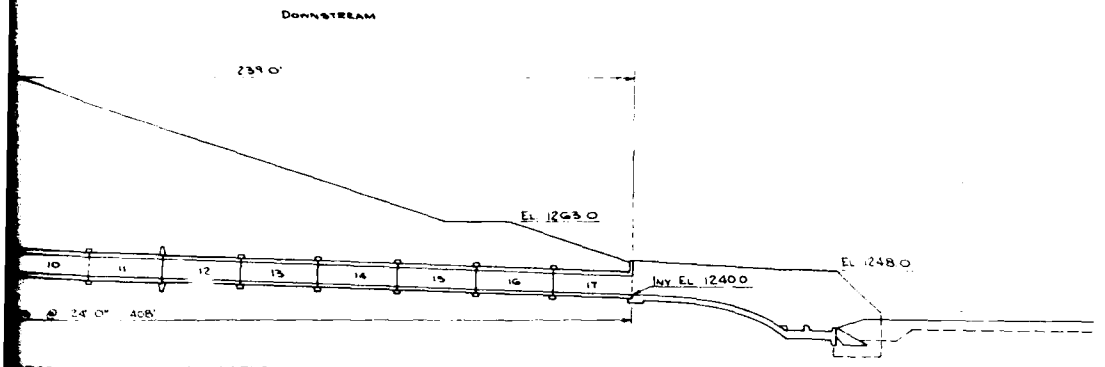
SALT CREEK AND IT'S TRIBUTARIES, NEBR
SITE 1B
BRANCHED OAK DAM
INTAKE STRUCTURE
VERTICAL MOVEMENT

APPROVED: CHIEF ENGINEERING DIVISION — DATE
SCALE AS SHOWN — SPEC. NO.
APPROVED: CHIEF, U. S. DISTRICT ENGINEER — DRAWING NUMBER — SHEET

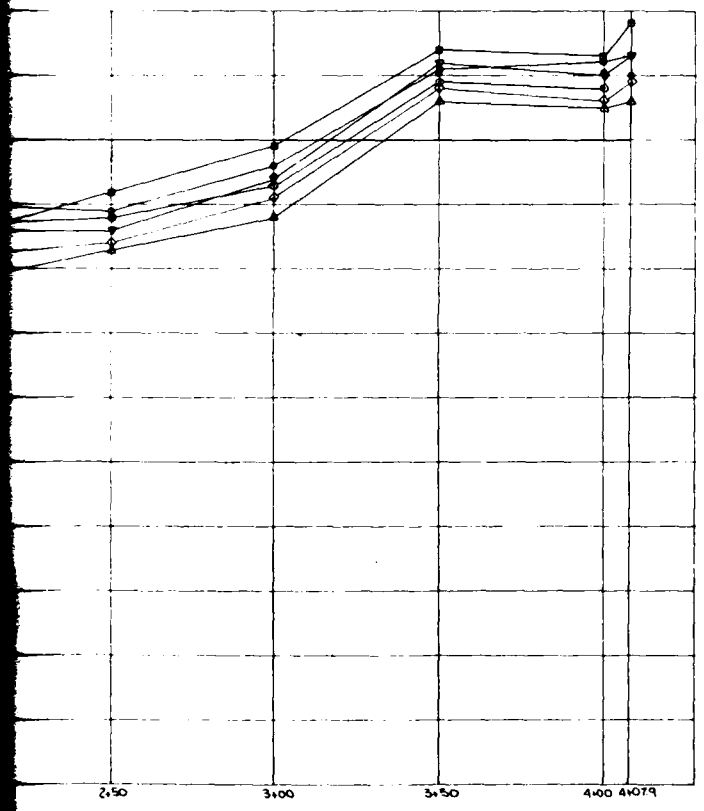
SAFETY PAYS

THIS PLAN ACCOMPANIES CONTRACT NO.
MODIFICATION NO.





SECTION THRU OUTLET WORKS
SCALE: 1 INCH = 20 FEET



LEGEND

- MAR 1967
- JAN 1968
- NOV 1968 (SURVEY ASSUMED TO BE IN ERROR)
- MAY 1970
- MAR 1972
- [illegible] 1974
- JUL 1977

NOTE
CONSTRUCTION SEP 1966 TO NOV 1967

DATE	DESCRIPTION	MADE	APPD
	REVISIONS		

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

SALT CREEK AND ITS TRIBUTARIES, NEBRASKA

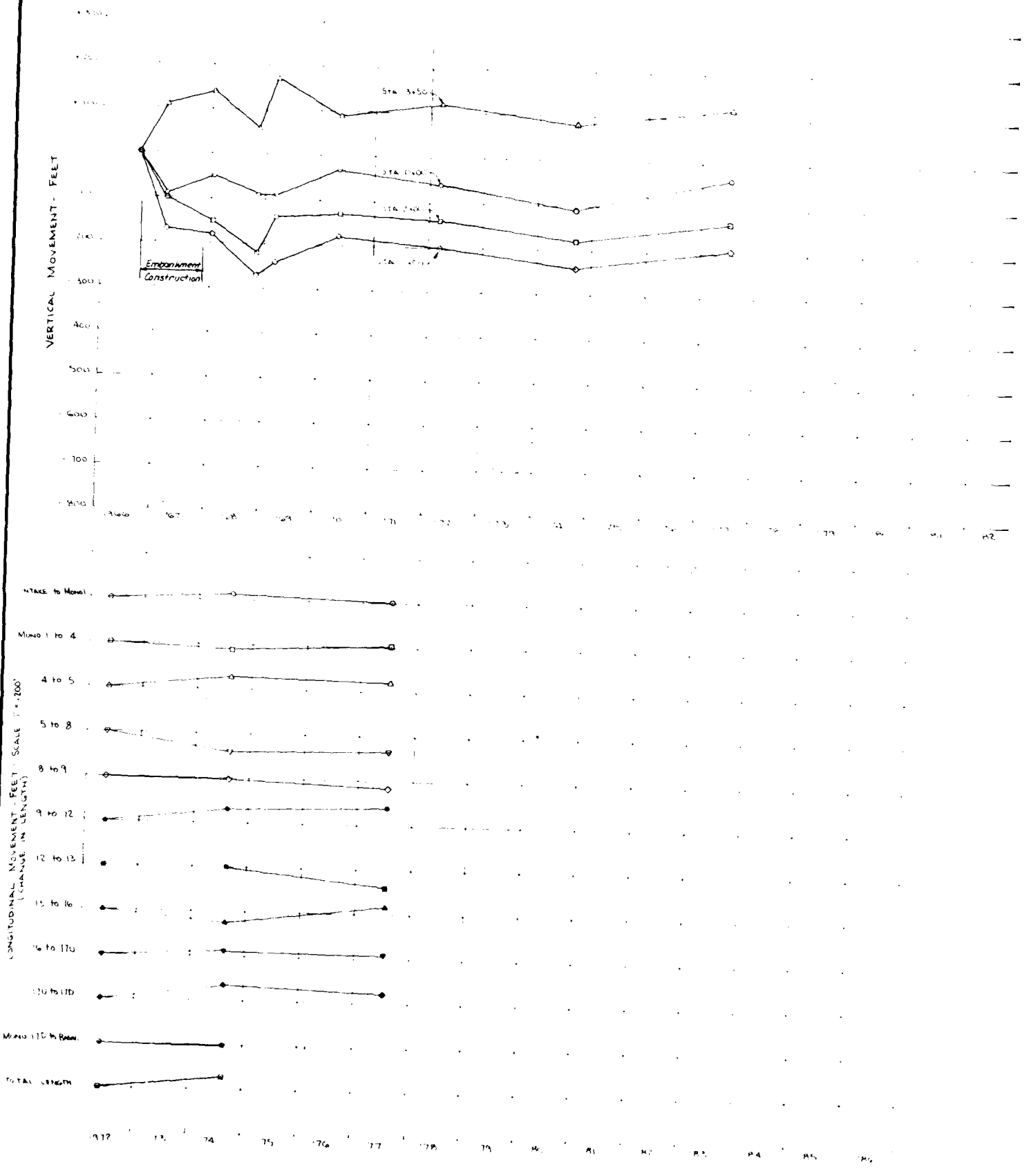
BRANCHED OAK DAM & RESERVOIR

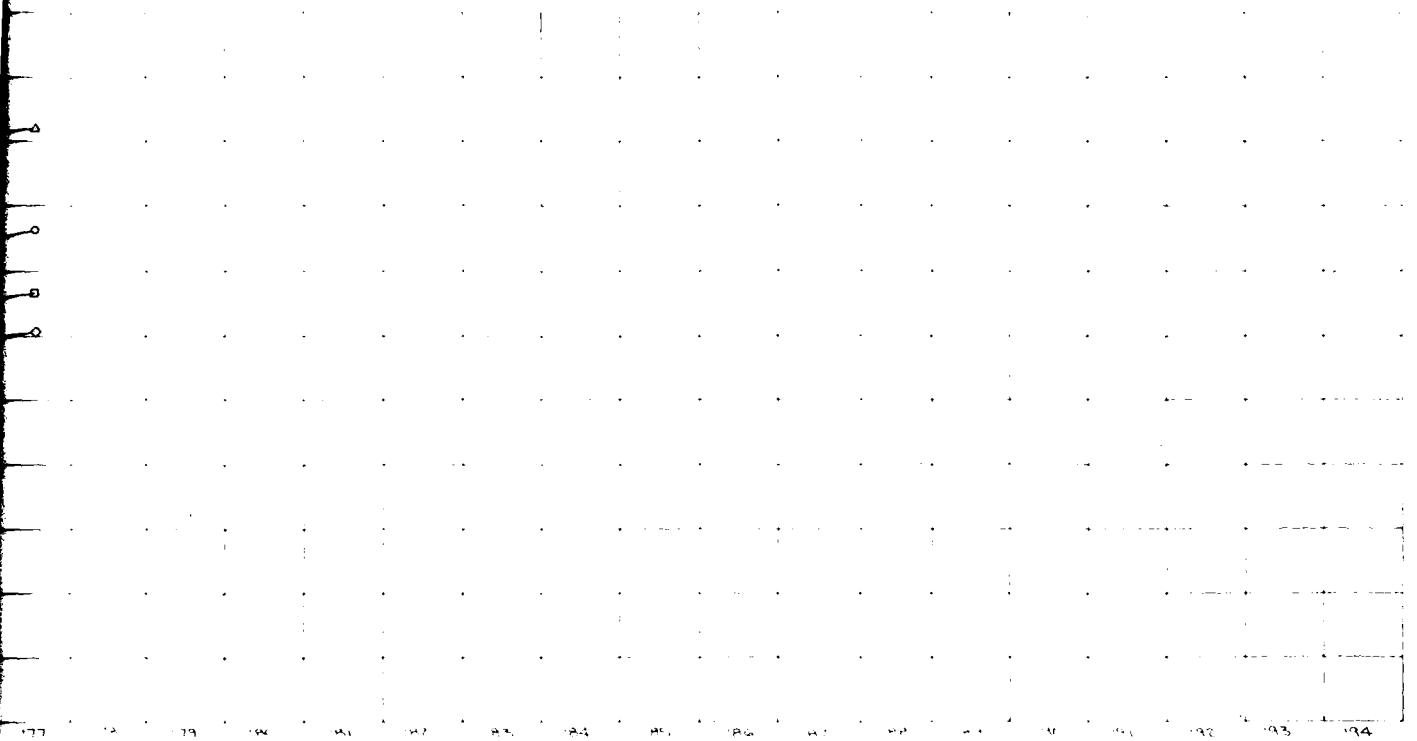
CONDUIT SETTLEMENT PROFILE

DESIGNED BY:
DRAWN BY: L.L.
CHECKED BY:
SUBMITTED BY:
CHIEF SECTION
APPROVED
CHIEF BRANCH
APPROVED
CHIEF, E & C SUPPORT DIVISION
APPROVED
CHIEF ENGINEERING DIVISION
DATE 26 APR 78
SCALE AS SHOWN
DWG. NO.
DESIGNED UNDER
CHIEF

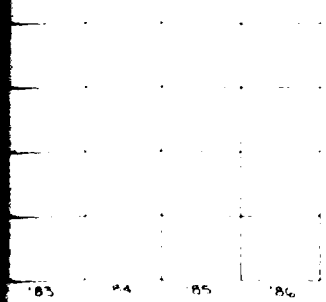
SAFETY PAYS

THIS PLAN ACCOMPANIES CONTRACT NO.
MODIFICATION NO.


VERTICAL MOVEMENT - FEET
Sta 3+50
Embankment Construction
LONGITUDINAL MOVEMENT - FEET - SCALE 1" = 200'
(CHANGE IN LENGTH)
Intake to Manol.
Manol 1 to 4
4 to 5
5 to 8
8 to 9
9 to 12
12 to 13
15 to 16
16 to 17U
17U to 17D
Manol 17D to Base
TOTAL LENGTH



See Plate C-5 for Outlet Works vertical movement profile



DATE	DESCRIPTION	MADE	APPD
	REVISIONS		

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

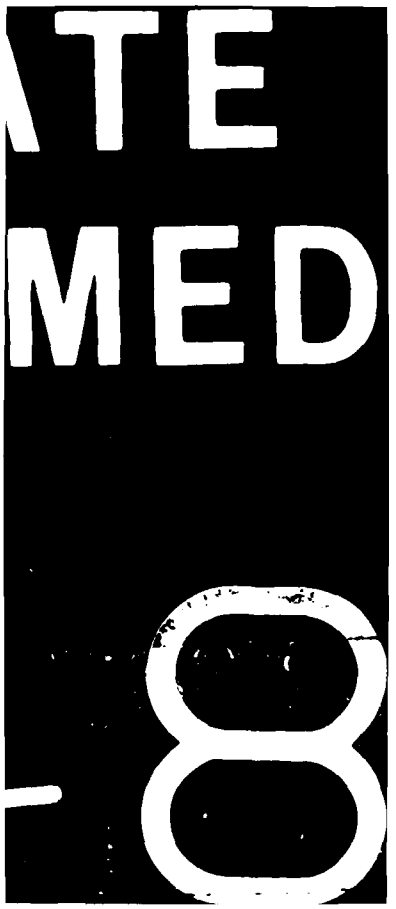
DESIGNED BY:
DRAWN BY:
CHECKED BY:
SUBMITTED BY:
CHIEF, DIVISION
CHIEF, BRANCH

SALT CREEK AND ITS TRIBUTARIES, NEBR.
SITE 1B
BRANCHED OAK DAM
OUTLET WORKS - CONDUIT
VERTICAL MOVEMENT- HISTORIES

APPROVED: CHIEF, ENGINEERING DIVISION
DATE:
APPROVED: COL, C. E., DISTRICT ENGINEER
SCALE AS SHOWN
DRWG. NO.
SHEET

SAFETY PAYS

THIS PLAN ACCOMPANIES CONTRACT NO.
MODIFICATION NO.


TE
MED
8